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GASTRO-INTESTINAL AUTO-INTOXICATION AND MUCOUS ENTERO-COLITIS FROM THE VIEWPOINT OF SURGERY

WITH ILLUSTRATIVE CASES

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THE pages of the current medical literature afford abundant evidence of the interest now being taken in the various phases of auto-intoxication. It is a subject which has long interested me, and I am of the opinion that its surgical aspect, especially the surgical aspect of the gastro-intestinal form, has not received by the many writers discussing it the attention it deserves.

The profession is enormously indebted to the bacteriologists who have worked out, or are working out, the flora of the gastro-intestinal canal. Our theory of the significance of the part played by the secretions pouring into this canal, from the cardiac orifice of the stomach to the anus, and of the part played by the phagocytes in contending against disease producing micro-organisms, which invade the system through the intestinal walls, is being rapidly recast. We know that millions of such organisms are to be found at all times in the gastro-intestinal canal; we are, unfortunately, not so sure of our premises when we come to deal with the significance of the several varieties there found, and with the best method of removing the conditions and lesions responsible for their activity. I shall endeavor to show by the introduction of several clinical cases that there are certain surgical and reflex causes which have been too long ignored.

In June, 1900, I published an article entitled Appendicitis Associated with Diseased Conditions of the Female Generative Organs (1), in which I tabulated fifty cases of appendicitis associated with more or less profound lesions of the uterine adnexa. I then analyzed the subjective and objective symptoms present in this series and found that digestive disturbance characterized about 75 per cent of the chronic cases therein reported. There was in the cases so characterized, emaciation varying from slight to extreme, indigestion with gaseous distension of both the stomach and bowel, coated tongue with foul breath, obstinate constipation, or alternate constipation and diarrhœa with varying amounts of mucus in the stools, indicating chronic mucous enterocolitis — a clinical picture duplicated by all writers in describing gastro-intestinal auto-intoxication. It was of course in this series difficult to determine whether or not the gastro-intestinal symptoms described were due to the appendicular or the ovarian lesions, or both combined, the cases all being women. Previous, as well as subsequent observation, has, however, firmly convinced me that chronic, catarrhal appendicitis does produce, and not infrequently, the same disturbance in the male. In another article entitled The Surgical Aspect of Indigestion and So-called Gastralgia (2), I enumer-

ated the surgical lesions responsible for indi gestion and stomach disturbance and discussed in detail those which not infrequently give rise to both indigestion and gastric crises. Such lesions are gastric ulcers, gastric dilatation and enteroptosis, pyloric strictures, gall-bladder lesions, movable or floating kidney, chronic appendicitis, intestinal strictures and adhesions, and diseases of the uterus and its adnexa. Those especially interested in this subject are referred to the articles mentioned. My object in this paper is to discuss the present status of gastro-intestinal auto-intoxication, to call atten tion to its frequent association with mucous enterocolitis, and to show that the profession is in a fog of uncertainties and inconsistencies regarding both gastro-intestinal auto-intoxication and so-called mucous enterocolitis.

So far as I am able to determine, my article of June, 1900 (3), was the first published emphasizing the significance of lesions of the pelvic organs and appendix in the production of mucous enterocolitis. There is at the present time comparatively little said upon the subject by those dealing with internal medicine. On the other hand, the surgeons and gynecologists, observing that gastro-intestinal disturbances disappear in a large per cent of cases after correcting certain surgical lesions, are coming to recognize that even slight changes in the appendix may perpetuate the gastro-intestinal irritation, which in turn gives rise to the symptoms of intestinal auto-intoxication with mucous discharges.

In order to show the diverse opinions which prevail at the present time regarding the etiology, pathology, and symptomatology, of these two conditions it will be necessary to quote freely from several of the more prominent writers upon the subject.

GASTRO-INTESTINAL AUTO-INTOXICATION

I shall deal with the chronic form only, as there is a pretty general consensus of opinion regarding the causation and significance of the acute types of infection.

Alexander (4) divides auto-intoxication into two great types, the endogenous, whose products are the expression of perverted metabolism; and the exogenous, which results from changes in substances which have never entered the circulation as a whole. He admits that the two types often intermix, as products of the endogenous type, passing into the intestines, intermingle with products of local fermentation, and the two are resorbed. A substance does not enter the system, according to this view, until it passes beyond the walls of the gastro-intestinal canal. Alexander believes that the endogenous form oftener results from nerve tire. The first effects of nerve exhaustion of the cerebrospinal system is to remove inhibitions on local nerve systems, which in consequence are unduly exalted and subsequently become exhausted. He lays especial stress upon the sanguifactive functions of the liver as a toxic factor. "Such disturbance," he says, "does more than interfere with proper blood supply, in that it adds a toxic element from a source that is properly nutritive and energy forming. Interference with eliminative elements produces an excretion which does not eliminate. The pale urine, for example, of nervous states is an expression of imperfect elimination with increased excretion. This is likewise true of certain bowel excretory conditions. Apparently complete action of the regular type by the bowel may be present, yet as shown by indicanuria there is clearly auto-intoxication with resorption of products of imperfect intestinal digestion. Indicanuria is an expression of undue strain on the kidneys through excretion of products which should be eliminated by the intestines."

Alexander (5) recognizes the relationship of gynecology to auto-intoxication and gives three general types: 1. Those in which pelvic conditions are produced by auto-intoxication. 2. Those in which pelvic conditions produce auto-intoxication. 3. Those in which auto-intoxication is at once the product of the pelvic states and aggravates these.

In the first type auto-intoxication may give rise to amenorrhœa, dysmenorrhœa, menorrhagia, leucorrhœa, etc. The second type includes the cases of uterine malposition and tumors, which, by interfering with the function of the bowel and acting in a reflex way so as to disturb digestion, give rise to auto-intoxication. In the third type he says that "uterine malposition and tumors, by their effect on the general tone increase nervous waste, and de-

crease elimination. To these last effects are due their alleged reflex action."

Dr. Edward C. Hill (6) approaches the subject from the standpoint of chemistry. According to Hill, "auto-intoxication creates, by depraving nutrition, the morbid opportunity essential for the pathogenic action of the nearly omnipresent germs, which poison the body by means of their toxins. Conversely, autogenic poisons are augmented in infected organisms through increased febrile disassimilation and alimentary putrefaction." He quotes extensively from Bouchard in the paper referred to. He observes (l. c. 47), that "old cultures of microbes contain substances capable of arresting the growth of these bacteria and it is possible that immunity depends on bacterial auto-intoxication, that is, poisoning of the germs by their own products." One function of the ductless glands appears to be the neutralization of intrabiontic endogenous poisons. The suparenals (Zucco) protect the economy against muscular poisons, that is, wornout pigments."

According to Blum, "the thyroid seizes and destroys enterotoxins developed by the action of bacteria in the intestinal canal. When the thyroid is absent or diseased, these toxins produce changes resembling myxœdema, as œdema, debility, stunted growth, and dulled mentality (cretinism), tetany, and subnormal temperature." Exopathalmic goiter may thus have its genesis in parathyroid insufficiency (7).

Mulot (8) asks the question, "Is gastro-intestinal auto-intoxication a disease or only a symptom?" He says, "There has been no evidence produced that these chronic gastro-intestinal auto-intoxications are due to a special pathogenic organism accidentally introduced and a stranger to the tract. On the contrary there are more than enough of them ever present to cause mischief. What then must occur that one variety or all of them become a source of trouble? Why does not everybody suffer from this trouble?" While admitting that the answer still lies in the future, and is in the domain of the still unknown, the purport of his article is that gastro-intestinal auto-intoxication is a symptom usually of liver insufficiency.

Anders (9) discusses the subject of auto-intoxication from the viewpoint of diagnosis. He deals first with the fact that the concept of different clinicians in recent times regarding the nature and importance of this condition has been widely different. Its pathogenesis is imperfectly understood, but says Anders, "It may be safely assumed that when the absorbing intestinal toxic substances — leucomains and ptomains — resulting from normal digestion, are found in abnormal amount, auto-intoxication occurs. . . Entering into the generation of these toxic bodies are three main factors: First, ingestion of too large quantities of albuminous foods; second, certain intestinal lesions, including defective motility brought about in a great variety of ways; and third, abnormalities of metabolism. . . . From recent personal experience and observation," continues Anders, "I am convinced that fat and sugar taken in quantities above the physiologic capacity of the organism are also responsible in certain cases at least. . . . It must be understood that the precise surplus in the process of proteid metabolism on which the chronic auto-intoxication is dependent, is as yet unknown. On the other hand, the functional and organic disturbances produced by the intestinal toxins in the various excretory tissues and organs are of decided clinical significance."

Under the head of etiologic factors, Anders says: "I would assign conspicuous positions to the following in the order given: First, impaired metabolic processes; second, errors in diet, or the ingestion of too large quantities of proteids, and, although less commonly, fats and sugar; third, constipation; fourth, intestinal pathologic states, as chronic appendicitis, mucous colitis and gastroptosis with or without coloptosis."

Kaufmann (10), while recognizing that the products of intestinal putrefaction, when absorbed without being properly changed or destroyed by the antitoxic activity of the intestinal wall, and particularly of the liver, may cause systemic disturbances, believes that there is a general tendency at the present time greatly to overestimate, especially in the French school headed by Bouchard, the rôle which gastro-intestinal intoxication plays in the development of certain diseases.

Taylor (11) states that "there is not a single reported, experimental, or clinical fact which is explained by the assumption of the resorption and non-distoxication of the digestive juices; nor has it been shown that the products of normal digestion ever act as toxins."

Anders (l. c.), under the head of diagnosis, says: "The positive recognition of chronic intestinal auto-intoxication presents many difficulties and it is necessary to exercise much care and reserve in the analysis of a given case. One is led to suspect intestinal auto-intoxication should he find any of the lesions heretofore enumerated (gastric ulcers, gastric dilatation, pyloric strictures, gall-bladder lesions, movable or floating kidney, chronic appendicitis, intestinal strictures and adhesions, and disease of the uterus and its adnexa), evidence of impaired metabolism with indigestion, migraine or periodic attack of headache, insomnia, obstinate constipation, or alternate constipation and diarrhœa, fæcal accumulation in the colon, the elimination of an increased amount of indican and the frequent presence of acetonuria. Other suggestive symptoms are nervous manifestations and, not infrequently, associated febrile, arthritic, and cutaneous lesions."

Forcheimer (12) gives a composite picture of 77 cases of chronic intestinal auto-intoxication as follows:

"1. Riggs' disease was present in 85 per cent of all the cases, 70 per cent had some form of stomach trouble, 94 per cent had some manifestation of bowel trouble.

"2. The urine was found to contain indican in abnormal quantities in 87 per cent of all the cases; calcium oxalate in 50 per cent, uric acid in 25 per cent, red blood corpuscles in 50 per cent, cylindroids were found in about 17 per cent, casts in 32 per cent, albumen in 9 per cent.

"3. In women nearly one-half were affected by some form of abnormal menstruation.

"4. Nervous symptoms were present in about 80 per cent of all the cases.

"5. Cardiovascular conditions were found in 74 per cent; neuroses, myocarditis, arteriosclerosis, etc.

"6. Locomotor apparatus symptoms occurred in 62 per cent — so-called gouty joints, hypertrophic arthritis, and especially muscular symptoms.

"7. Skin lesions were found in 28 per cent."

Forcheimer emphasizes the importance of derangement of the stomach, which in turn gives rise to bowel trouble and consequent auto-intoxication. Diminution of HCL, and motor insufficiency of the stomach with stagnating food favor the growth of bacteria. Constipation always produces retention of fæcal matter and this favors auto-intoxication, as is well known. In the treatment, all those conditions which prevent normal peristalsis should be looked for and carefully treated. Such conditions are chronic enteritis, peritonitis, obstructive conditions from within or without the intestines, and chronic appendicitis. In the 77 cases referred to, ten had appendicitis; five were operated on and with the removal of the appendix the auto-intoxication disappeared. Albumen and nuclein foods should be, according to Forcheimer, avoided as much as possible. Albumen, except that from milk and vegetables, and possibly eggs, because it is affected by the causes of intestinal putridity, and nuclein, as the alloxuric bodies, including uric acid, are formed from it.

Mulot (13) believes that there is experimental and clinical evidence that gastro-intestinal auto-intoxication is merely a symptom of liver insufficiency.

Morgan (14) deduces from the study of 82 cases the following: "First, the formation of the toxins is in the lower segment of the small gut and the colon. Second, the chief distributing center of the toxins is the colon. Third, the underlying cause producing the toxins is imperfect digestion of the proteid food stuffs in the small gut. . . . The symptoms bear a direct relation to the degree of indicanuria. An almost constant symptom-complex is as follows: Malais, headache, confusion of mind, insomnia, vertigo, impaired memory, and great mental irritability. These manifest themselves as soon as indican appears in excess in the urine and persist for a greater or less time after the urine becomes normal. He believes that in many instances the underlying cause of the disturbed intestinal digestion is nervous depression. "The treatment, therefore, must be directed to the

cause and must come through preventing the formation of toxins, and what is quite as important, the elimination of the supply already on hand.''

Carl von Noorden, in his classic essay on Acid Auto-intoxications (15), makes the following observations: "The alkalinity of the blood depends upon several compounds. First, compounds with an alkaline reaction (sodium carbonate and sodium phosphate), and second, large quantities of alkali combined with mineral acids. Herbivorous animals quickly die under the administration of acids. The acid is neutralized in carnivorous animals because of the ammonia manufactured by the proteids. Excessive accumulation of acids in the system occurs in two ways: (*a*) The excretion may be reduced. (*b*) The formation may be increased. From the first the danger is slight. The acids that are responsible are known as "acetone bodies.'' The presence of acetone in the urine, according to von Noorden, has been credited with too much importance. The alkalinity of the blood is always greatly reduced in diabetic coma. Lessened carbohydrate feeding causes acetonuria. Acetone bodies are probably an intermediate product of normal metabolism.

Chapman (16) calls attention to the well known fact that a disease may both cause auto-intoxication and be caused by it. Thus, he says, nephritis may be caused by endogenous as well as exogenous poisons circulating in the blood stream and with this nephritis comes decreased functional power and failure of elimination proportional to such loss. Similarly do conditions like gastric dilatation and cirrhosis of the liver act in the production of auto-intoxication. While admitting that auto-intoxication may give rise to epileptic forms of convulsions, it is necessary in order that the epilepsy continue in regularly repeated attacks, that there be a predisposing cause set into operation by a toxic acid. Other conditions which may be caused by auto-intoxication according to Chapman, are tremor, infantile convulsions, gastric tetany, skin diseases of various kinds, depressed states, insomnia, and insanity.

Herbert J. Paterson, F. R. C. S., has given the profession, under the title Appendicular Gastralgia, or the Appendix as a Cause of Gastric Symptoms (20), what in my opinion is one of the most timely and important essays to be found in recent medical literature. He was prompted to write this essay by observations made in the Mayo clinic in 1907. He also refers to essays on the same subject by Moynihan (21) and Ewald (22). He gives several clinical cases in which it was exceedingly difficult to differentiate gastric symptoms due to appendicular disturbance from gastric or duodenal ulcer. Five of his patients vomited blood on one or more occasions, the amount in one case being 50 ounces. In one case when the stomach was opened the whole of the mucosa was studded with numberless bleeding points. He believes that the hæmorrhage in these cases is due to the irritation resulting from the hyperacid gastric juice. In a large majority of the patients the pain followed the ingestion of food, although the intervals between the taking of a meal and the onset of the pain were variable. In most cases the pain is referred to the epigastrium, usually to the right of the middle line. In 24 cases the stomach, duodenum, and gall-bladder were explored and in 15 of the cases were found healthy; the appendix was then sought for and as it showed evidences of disease was removed. In several of the cases where relief was derived from appendicectomy the appendix was not extensively diseased. The most common condition found was a thickening of the organ with constriction near its base, the distal end being bulbous. A concretion was found in exactly half the cases. In theorizing as to how the gastric symptoms are produced, Paterson believes that they are due to intestinal stasis. "This theory'' he says, "is supported by the frequency with which the duodenum is found markedly dilated at operation, and by the fact that in one of the cases the stomach was dilated also. Further, as a rule the quantity of gastric juice evacuated after a test meal is greater than in healthy individuals, the percentage of volatile acids is usually increased, and in addition flatulence and constipation are prominent symptoms."

Another article equally timely is that of W. Soltau Fenwick, entitled The Clinical Significance of Gastric Hypersecretion and its Con-

nection with Latent Disease of the Appendix (23). He says, "Until the year 1907 I had convinced myself from post-mortem evidence, as well as from the more limited data afforded by operation, that 88 per cent of all cases of chronic hypersecretion were associated with a demonstrable lesion of the digestive organs, while in the remaining 12 per cent no disease that appeared to have any immediate connection with the stomach could invariably be detected. I was, however, well acquainted with a peculiar type of hypersecretion in which death frequently occurred from appendicitis, and was in the habit of warning the subjects of this complaint of their especial liability to inflammation of the appendix; but it was not until an opportunity occurred in that year of discussing the subject with Dr. W. J. Mayo, that the cause of this appendicitis, and also an explanation of the 12 per cent of cases hitherto unexplained, at once became apparent." The following is an analysis of 112 consecutive cases of chronic hypersecretion:

Chronic ulcer of the stomach existed alone in	12
Chronic duodenal ulcer existed alone in	46
Gall-stones existed alone in	12
Disease of the appendix existed alone in	22
Gastric and duodenal ulcers coexisted in	3
Duodenal ulcer and gall-stones coexisted in	3
Gastric ulcer and diseased appendix coexisted in	5
Duodenal ulcer and diseased appendix coexisted in	4
Cancer of the pylorus existed alone in	4

In another place Fenwick observes: "So far as my limited experience goes the symptoms vary to a great extent according to the nature of the appendicular lesion and the comcomitant state of the gastric secretion. Thus, when the appendix is in a state of active irritation, such as ensues from ulceration of its mucous membrane or the presence of a calculus, pain is always a noticeable feature, and a gastric analysis shows both hyperacidity and moderate food retention. On the other hand, if the appendix is merely thickened or adherent, owing to a former attack of acute inflammation, the symptoms of the gastric disorder are identical with those of chronic inflammation of the stomach, and subacidity, with an absence of free hydrochloric acid, is the rule. *In every instance of this latter kind that has come under my notice the patient was thin, anæmic, and despondent, and was obviously suffering from general neurasthenia.*"

Christopher Graham (24), under the caption of Differential Diagnosis of Diseases Causing Gastric Disturbance, says: "Chronic recurring appendicitis is a type that usually gives stomach symptoms. There is no appendical tenderness, no pain at McBurney's point, no fever, no tumor, no symptoms that usually mark appendicitis, except those referred to the stomach. There may be pain, gas, vomiting, sour stomach, and pyrosis, but when compared with peptic ulcer they are irregular, and when gall-stones are considered the attack is too prolonged. The whole train of symptoms is caused more often immediately by food, but this meal gives one effect and the next meal another; there is no regularity, meal after meal, as in chronic ulcer, and rarely does food give ease. Pain is often a queer, rather continuous distress, which is epigastric or indefinitely abdominal, which the patient describes as epigastric. There is no clean-cut day by day repetition, as in ulcer, and no attacks like gall-stones, of definite location of pain. Nausea, distress, a gassy, bloated condition covers the bad feeling of more cases of chronic appendicitis than of chronic ulcer or gall-stones. Exertion is a factor in appendicitis and sufferers from it are seemingly often unable to work. Pain may be epigastric only, but often indefinitely of the epigastric and abdominal regions or low gall-bladder or high appendix areas. If we have dyspeptic attacks with epigastric pain and radiation to the umbilicus or lower abdomen, consider, first, appendical disturbance."

MUCOUS ENTEROCOLITIS

This disease or symptom is known also as colica mucosa, colitis, pseudo membranacea, membranous catarrh of the intestine, and myxoneurosis coli; terms which at once suggest the prevailing confusion regarding its causation, nature, and significance. Until comparatively recently the internists have declined to consider the possibility that in at least a given per cent of the cases characterized by the free discharge of mucus per anum the cause may be local rather than systemic. Indeed it is only in the later surgical writings that one finds mentioned and merely mentioned, mucous

enterocolitis as a symptom of chronic appendicitis.

Lesions of the uterus and its adnexa, except as they may interefere with peristalsis in a mechanical way, are practically ignored as factors in disturbing digestion and thereby exciting and perpetuating the abnormal discharge of mucus. Von Noorden (17) takes issue with the views expressed in more recent publications on colica mucosa in that they concede the rôle of inflammatory processes in the genesis of the majority, if not all, the cases of this affection. He, however, admits that there is a number of very valuable post-mortem reports on record that demonstrate positively that a disease picture corresponding to colica mucosa may actually be observed in cases of genuine enteritis, though Hemmeter (l. c., p. 486) subjected certain portions of the colon that were covered with a thick layer of mucus to careful macroscopic and microscopic examination, and failed to find any histologic evidence of inflammation. This view is also held by Rothmann (18). Nothnagel (19), on the other hand, recognizing the duplex character of colica mucosa, believes that there are two forms of the disease, the one with, and the other without, inflammatory phenomena. He therefore separates the two forms and calls them by different names; thus he speaks of "enteritis membranacea" and of "colica mucosa." The latter form he believes to be always of neurotic origin.

H. Westphalen (25), together with v. Leube, believes that the formation of the membrane is dependent upon some nervous affection. von Noorden (l. c.) says that the great majority of cases give a history of considerable digestive disturbance for a long time preceding the onset of colica mucosa. He enumerates more specifically as symptoms, dyspepsia with superacidity, cramps in the stomach, a tendency to diarrhœa, persisting for years; in a large number of cases, however, there is long continued constipation. The foregoing symptoms, he thinks, frequently occur without organic changes and are purely functional in character, but he admits that occasionally we find a history of more serious organic disease with true anatomic lesions; thus, e. g., in several cases a history of appendicitis, and on autopsy demonstrable thickening and adhesions of the tissues in the vicinity of the appendix vermiformis. He calls attention to the fact that all the diseases enumerated may impede the movements of the bowels and considers them most important from this point of view. He cites (l. c., p. 26) the case of a girl of 25 who was brought to his department of the clinic in a semiunconscious condition from pain, and whose symptoms so closely resembled obstruction of the bowel that surgical relief was seriously considered. This is a possible diagnostic error which should receive careful attention. He believes (l. c., p. 28) that the pain, which may vary in each case, is dependent upon mechanical or chemical irritation of the mucus on the one hand and on the individual sensibility of the patient on the other. He notes the fact that mucus is normally secreted in all portions of the large intestine in greater or less amount; that it is only when there is an overproduction that it is noticeable without a thorough chemical examination.

Hemmeter (26) says that careful thermometric observations have led him to believe that three-fourths of the cases of chronic appendicitis with mucous colitis passing under his observation carry a temperature of 100° F. In the larger per cent of cases there will be found upon examination a thickened appendix which can be felt upon palpation as a cord-like mass; pressure not infrequently involves the stomach in a reflex way.

Kelly (27) gives as prominent symptoms of chronic appendicitis, obstinate constipation, dyspepsia, especially after indulging in certain articles of food, flatulency, which is not infrequently confined to the ileocæcal region. Kelly agrees with Czerny that the flatulency is probably due to a condition of stasis, owing to the presence of adhesions which inhibit to some extent the normal muscular contractions. Other symptoms, according to Kelly, of the disturbed digestion are a furred tongue with nausea, diarrhœa, which at times alternates with constipation, or may be a constant symptom. Pain and tenderness are usually present in the right abdomen, although he emphasizes the fact that there is scarcely a spot in the whole abdomen to which the pain may not be referred. Kelly says, "*The association of membranous*

colitis, and chronic appendicitis is frequently observed.'' Finney (l. c.), has especially noted its occurrence in cases where there is a thickened chronically inflamed appendix, densely adherent to neighboring intestines. "Some writers,'' continues Kelly, "have attributed the disease of the appendix to the influence of the chronic colitis, but the evidence as a whole is in favor of the appendical origin of the trouble, the affection of the colon being secondary. In many instances acute attacks of appendicitis have antedated the appearance of the symptoms of colitis, and it is a common experience to find that the latter is entirely relieved by the removal of the appendix.'' At a later period Kelly wrote (28): "Chronic appendicitis usually manifests itself by the presence of abdominal pain, generally located in the right side and often associated with digestive disturbances, especially constipation and flatulency. The somewhat frequent association of mucous colitis with chronic appendicitis,and the relief obtained in some cases after the removal of the appendix suggest the existence of an etiologic relationship between the two affections.''

Lapeyre (quoted by Kelly), describes six cases in which coincident appendicitis and mucomembranous colitis were cured by the resection of the appendix.

Dr. John B. Murphy (29) discusses at some length the frequent association in females of disease of the vermiform appendix and the female generative organs. Boothby (30), Baldy (31), Richelot (32), Mixter (33), Robb (34), Jaggard (35), Bickley (36), H. McGuire, (37), Deaver (38), Kelly (39), Keene (40), Vineberg (41), and Wood (42) reported cases more than fifteen years ago showing that such association is often met with. Murphy observes that the appendix may be primarily involved and affect the genitalia secondarily or vice versa. He, however, admits that a positive diagnosis as to the primary involvement of the appendix or pelvic organs is often difficult, even after opening the abdomen and inspecting the organs. He lays especial emphasis upon the fact (l. c., p. 772) that there is a distinct difference between recurrent appendicitis and chronic appendicitis. "The term recurrent appendicitis should be,'' he says, "reserved for the cases which have recurrent, acute, inflammatory attacks with all the symptoms of primary seizure, while the term chronic appendicitis should include all of the chronic symptom-producing conditions of the appendix other than those embraced in the preceding special headings.'' "These appendical lesions,'' continues Murphy, "produce grave disturbances of the digestive equilibrium, even where the anatomical changes in the appendix are comparatively small. . . . . The clinical picture is not by any means definite or clear. Some complain of gastric disorders; others of intestinal symptoms; still others of a combination of the two. Some have anorexia and a symptom-complex suggestive of gastric ulcer for which Longuet introduced a particularly appropriate term, appendicular dyspepsia. Many suffer from constipation, others from a mild colitis. Micturition is more frequent. Some patients complain of a continual heaviness in the abdomen and of a distress in the right side of the abdomen when lifting or bending the body. Patients generally lose weight, becoming pale and anæmic; many of them are neurotic. Physical examination may reveal some tenderness in the region of the caput coli; many times, however, such an examination is negative. Very frequently in chronic cases a considerable distension of the caput coli may be found. The temperature is as a rule normal throughout. The leucocyte count is in the vicinity of 8,000 to 9,000 and is fairly constant.''

Kemp (43) gives as an etiologic factor of mucous enterocolitis, pressure from tumors which narrow the canal, giving rise to fæcal accumulation. He differentiates intestinal dyspepsia from chronic mucous enteritis from the fact that in the latter condition there will always be found mucus with epithelial and round cells, while the stools are alkaline and of strong fæcal odor; whereas in the former the stool consists of pure mucus alone.

Rutherford Morison (44) says, "There are good reasons for believing that anæmia, indigestion, and some forms of colitis have a relation to changes in the appendix that may give the chief evidence of disease and can only be removed by removal of that organ.''

L. Cheinisse (45) affirms that in order to

justify the opinion that the mucus is due to nervous hypersecretion, the stools in the intervals of nervous attacks must be entirely free from mucus.

Nepper (46) says that "to be constipated means to have an insufficient biliary secretion, the result of innumerable causes; suffering from enterocolitis means constipation and evacuation of coagulated mucus — that is, to have an insufficient secretion of bile."

On one point nearly all of the writers quoted are agreed, namely, that many cases of arteriosclerosis are directly traceable to auto-intoxication, no matter what may be the predisposing and exciting causes of the latter condition. It would be interesting to go into this phase of the subject in detail, but space forbids. Suffice it to say that in dealing with long existing auto-intoxication one should always note the blood pressure and examine carefully for other evidences of arterial degeneration, directing the treatment, when it is present, accordingly. In many of the cases, too, there will be found, even though the arterial pressure is normal, symptoms of what Bandler (47) has designated "relative Basedow's or Graves' disease." These patients are nervous and hysterical and suffer from indigestion tachycardia, unnatural flushes, cold hands and cold feet, slight enlargement of the thyroid, urinary disturbances, and morbid perspirations. I have endeavored to show in articles previously published (7, 48) that many cases of Graves' disease occurring in women are the result of pelvic lesions, acting reflexly through the circulation or upon the thyroid itself; or possibly by first disturbing metabolism by interfering with digestion. I am confident that too many throidectomies are being done for Graves' disease, a condition which will, as I have shown in a series of recorded cases (l. c.), not infrequently disappear after correcting appendical, pelvic, and rectal lesions. The intimate relationship existing between the female pelvic organs and the thyroid is referred to later on in this paper.

PATHOLOGY

In a large per cent of appendices chronically affected the organ will be found thickened. This is due to strictures which are usually present, with more or less distension, which excites tenesmus and muscular hypertrophy; or it may be due to inflammatory infiltration. In either event the mucous membrane at the point of stricture becomes eroded and the stricture in time becomes absolute or nearly so. I have placed on record a somewhat remarkable case of cystic distension of the appendix (49). My observation, however, leads me to believe that the marked cases of cystic distension entirely shut off from the bowel do not give rise to as great a degree of bowel irritation as do the minor forms of inflammation which still communicate with the bowel. The patient from whom the appendix shown (see Plate, Fig. 2) was removed, suffered for 15 years from indigestion of the most marked type and had both mucous enterocolitis and gastro-intestinal auto-intoxication. Within ten days following the operation he was eating with comparative impunity almost everything he wanted. Progressive obliteration of the lumen of the appendix had taken place, a condition which was, I believe, first described by Senn (50), who gave to it the name of "appendicitis obliterans." Zuckerlandl (51) found the lumen obliterated in 55 out of 232 cases.

Kelly (52) under the head of residual appendicitis shows several cases illustrating the many deformities which may follow in the train of acute or chronic inflammation of the organ.

In most instances upon section there will be found a general infiltration of lymphoid and plasma cells, collected usually in clumps and along the course of the vessels.

The *treatment* of auto-intoxication, if the foregoing premises are in harmony with the facts, logically resolves itself into (*a*) dietetic, (*b*) therapeutic, and (*c*) surgical.

In the selection of a *diet* Alexander (l. c.) emphasizes the necessity of reducing the energy foods which tend to cause intestinal disturbance, thus relieving the strain through fæcal absorption upon the kidneys, liver, and lungs. He also advises the reduction of starches, like potatoes, bananas, old cabbage, turnips, parsnips, etc., in all persons whose labor is not manual.

According to Bignault and Suckdorf (56) the body each day expels through the dejecta from fifty to eighty billion microbes, there

having already been differentiated some 44 varieties. There seems to be no question but that our vegetarian friends are right in claiming that a much larger number will be found when meat is consumed than when the diet is exclusively vegetable. Nearly four hundred million aerobic germs per gram of moist material were found in round steak taken from the table of a prominent city hotel. In many instances, especially where there is arterial sclerosis, an exclusive vegetable diet is advantageous. Large quantities of water are beneficial in flushing the kidneys and stimulating the hepatic and intestinal secretions. At least three quarts should be taken during the 24 hours. Constipation is not infrequently cured by the consumption of large quantities of water. Where constipation is present, the bowels should be kept open, preferably by means of enemata of normal salt solution administered in the knee-chest position. The too persistent use of cathartics in treating constipation is to be deprecated. Fruits, especially the acid varieties, are nearly always helpful. Exercise and plenty of fresh air are of the utmost importance.

Le Sage in 1888 first promulgated the idea of employing the result of bacterial activity to counteract putridity in the intestine (Forcheimer). Later, Pasteur made an attempt to destroy bacteria by the activity of others which are antagonistic to them. It was, however, left to Metchnikoff to desert the phagocyte and proclaim that premature senility is due to the remnants of digestion in the colon which are exposed to putrefactive bacteria, the results of which are absorbed. Metchnikoff recommends in order to prevent such putrefaction, the ingestion of lactic acid-forming bacteria in milk, choosing the b. bulgaricus. In order to improve the taste of the preparation he combines this with the streptococcus lactius. This preparation is now put on the market in the form of tablets, which consist of b. bulgaricus, streptococcus lactius, and a yeast. The laity and, I fear, the profession as well, are now working the buttermilk treatment of intestinal auto-intoxication for probably more than it is worth.

Forcheimer (l. c.) thinks that in women the ovarian internal secretion, or the lack of it, does not a little to cause symptomatic discomfort. He has benefited cases thus affected, by the administration of the ovarian extract.

In the *medical treatment* of mucous enterocolitis von Noorden places especial emphasis upon rest in bed, hot applications, the use of narcotics, water enemata, high oil clysmas and, contrary to all previous teachings, a coarse laxative diet. The reader is referred to von Noorden's brochure (15) for the detail of this diet. He emphasizes, too, the importance of massage of the large intestine, and of securing a normal action of the bowels.

Kemp (43) enumerates the mechanical causes of enterocolitis and insists that if there is enteroptosis, this condition should be surgically overcome. He cites two cases recorded by Gart which were cured by drawing up the colon and stitching it to the abdominal wall. If parasites are present, they should be destroyed. The patient should be relieved if possible from all anxiety and worry. Hydrotherapeutic measures are of infinite value in nearly all instances. Buttermilk as an article of food is very often useful. If there is constipation, the administration of olive oil per rectum in quantities varying from one pint to one quart is advantageous. As local measures he advises saline enemata for the purpose of emptying the bowel, with local applications of listerine, glycothymoline, tannic acid, salycilic acid, flax seed tea, gum arabic water, nitrate of silver, and protargol. If all these measures fail, he recommends appendicostomy or cecostomy.

Mendez (54) treats enterocolitis by giving large doses of bismuth for the purpose of mechanically protecting the mucous membrane.

Wallis (55) also considers appendicostomy a most satisfactory method of treating obstinate cases of mucous enterocolitis.

While each case should be treated symptomatically, personally I have found small doses of chloride of potash (kali muriaticum), corrosive sublimate (mercurius cor.), and hydrastis canadensis oftener indicated than are other remedies.

Admitting that chronic mucous enterocolitis is not infrequently associated with a true inflammatory process, it is not difficult to understand how it may have its origin in, and be per-

petuated by, a chronically inflamed appendix. With such an appendix there exists constantly in the region of the cæcum an infecting focus which may at any time implicate the immediate vicinity of the appendix, thereby giving rise to more or less acute inflammatory attacks. The inflammation thus excited may extend by continuity of tissue over large areas of the bowel mucosa; or the pathogenic organisms located in or about the appendix may find their way upward or downward, exciting by their presence enteritis. Nor does it seem unreasonable, in the absence of a more plausible theory, that mucous enterocolitis from whatever cause may, because of the abnormal secretion which suggests its name, afford a culture medium, which in turn, because of the resulting fermentation, gives rise to intestinal auto-intoxication. This theory is in harmony with the fact that both mucous enterocolitis and intestinal auto-intoxication usually disappear when the inflamed and irritated appendix is removed, providing, of course, there are not left behind other lesions which are in a measure responsible for the existing symptoms. Neither is it difficult to understand the causal relationship existing between gross lesions of the stomach and intestines (dilatation, displacements, etc.), and of the female pelvic organs, and intestinal auto-intoxication. We are not on the other hand so sure of our ground in our efforts to trace such relationship when we have to do with the minor lesions within the female pelvis which do not interfere with bowel peristalsis by direct pressure. We must in order to do so revert to our physiology.

It may be written down, as at least a working hypothesis, that when a physiological change in an organ, or in organs, is capable of affecting near or remote parts in a physiological way, pathological changes in the same organ or organs may and frequently do implicate the same parts. By way of illustration:

The mammary glands begin to enlarge almost immediately upon conception; they likewise respond to lesions of the uterus and ovaries, so that mammary pain and engorgement are common symptoms of such lesions. All physicians have I think repeatedly cured indurated and circumscribed growths of the breasts (chronic mastitis) by directing treatment to the pelvic organs. Nausea and vomiting so frequently follow conception that it constitutes one of the classic symptoms of pregnancy. While it cannot be said that this is a physiological condition, women otherwise in seeming perfect health suffer during pregnancy from this symptom so constantly that it may be classified as physiological. Pathologically, the stomach is one of the first organs, distant from the pelvis, to suffer because of disease of the uterus and ovaries. Salivation is likewise a common symptom of pregnancy and there are many well authenticated cases of profuse salivation in the non-pregnant, which only disappeared after directing treatment to the pelvis (57). Enlargement of the thyroid is not an uncommon symptom of pregnancy and the tendency of this gland to enlarge during puberty and the menopause is additional evidence connecting it both physiologically and pathologically with the female reproductive organs. While the causal relationship existing between morbidity of the internal secretions and gastro-intestinal auto-intoxication is yet in doubt, we have seen that such relationship is more than suspected by Hill and Blum. We know, too, that lesions exciting or depressing the sympathetic nervous system may and frequently do, by perturbing the arterial system, interfere with digestion. I need only refer to the flushes and anæmias of the menopause, to the palpitations and congestions of puberty, as well as to the nervous phenomena which characterize these crises, to show the close sympathy existing between the pelvic organs and the circulatory. The well known "sickening sensation" excited by ovarian pressure is additional evidence that reflexly the stomach is one of the first organs to suffer when the ovary is implicated. In short, the evidence going to show that digestion may be disturbed by pelvic lesions acting reflexly with consequent intestinal auto-intoxication, is overwhelming. I have in my case book a record of several hundred cases, which I shall analyze in detail at another time, cured or immeasurably benefited by correcting such lesions. In the final analysis of this entire subject the positive evidence afforded by clinical demonstration is a thousandfold more valuable than are all of the many theories promulgated.

A careful inquiry into the history of these cases leads the examiner to suspect that many times the disturbing lesions, especially those of the appendix, date back to early childhood. At least the victims say that as children they were not strong and suffered from indigestion and indefinite abdominal pains. As time goes on they become phlegmatic, anæmic, and flabby fibered, with cold hands and cold feet, suggesting an impoverished blood supply. Toxic neuritides, especially involving the region of the nervous trigeminus, are often most distressing. The hæmoglobin is low and the red cells are usually below 4,000,000. As a rule they are constipated, or there is alternate constipation and diarrhœa, with mucous stools and not infrequently there are hæmorrhoids or other rectal lesions. In perhaps ten per cent of the cases the thyroid is more or less enlarged, and there may be symptoms of incipient Graves' disease. The mentality is frequently below par and usually the victims become melancholic or exceedingly neurotic. The proposition that all children should have their appendices removed as a prophylactic measure is of course absurd, but I sometimes wonder whether, in these days of municipal paternalism, we are not in our enthusiasm in looking after the eyes, teeth, and throats of backward children, derelict in ignoring the part played by chronic appendicitis and, in girls, diseased or displaced reproductive organs, in interfering with the metabolism of the growing child, thus retarding both its physical and mental development.

ILLUSTRATIVE CASES

CASE 1. Patient aged 46, exceedingly nervous, wept constantly, had melancholia of a suicidal type, there was indigestion, obstinate constipation, menorrhagia, leucorrhœa, backache, and a "bearing down" sensation. She was anæmic from the loss of blood and had frequent attacks of migraine. The urine showed indicanuria.

Physical examination. The uterus was sharply retroflexed, was large and heavy with both ovaries under the fundus. The cervix was large, hard, and lacerated on either side, and the pelvic floor relaxed. The appendix was palpable.

On November 18, 1908, I did a divulsion, a curettage, removing a large amount of debris, amputated the cervix, overcame the relaxation of the pelvic floor by the flap splitting method, dilated the rectum, overcame adhesions of the clitoris, opened the abdomen and removed a long, thickened appendix (see Plate, Fig. 1), which contained two fecaliths, and did the internal Alexander operation. Convalescence was uninterrupted and to-day (May 3, 1910), she is happy and well. While she is still menstruating, the discharge is normal in quantity, her indigestion has subsided, she has taken on flesh, her nervous symptoms have vanished, and she is enjoying life as she has not for years.

CASE 2. Patient aged 27, came to me in June of 1907 suffering from severe pain in the right side, which had been diagnosed by various physicians as appendicitis, ovaritis, and gall-stone colic. She was a thin, emaciated little woman with frequent attacks of diarrhœa, marked indigestion, intestinal fermentation, and mucous enterocolitis. The urine was of very low specific gravity, the urea being one-tenth of one per cent indicanuria.

On June 24, 1907, through a median incision, I explored the gall-bladder, the liver, and the right kidney to find them apparently normal. The right ovary was hard and cirrhotic and was therefore removed. The appendix was thickened and adherent and was tied off in the usual way (see Plate, Fig. 3). The left ovary was apparently healthy and was left behind. Convalescence uninterrupted. The indigestion and diarrhœa entirely disappeared and, except for vaginismus, which is a feature of her neurotic temperament, she is enjoying excellent health.

CASE 3. Patient aged 30; one child eight months old, breech presentation; married for eight years. For at least ten years she has suffered from menorrhagia and from indigestion, with mucous enterocolitis, headaches, and constipation. She was confined to her bed for one year with an attack of nervous prostration, during which time she was treated by Christian Science.

Physical examination showed a bad bilateral laceration of the cervix and the sphincter ani was torn into the rectovaginal septum for two inches. An unsuccessful effort was made to repair this injury at the birth of her child; no control of the gases or liquid stools. The uterus was sharply retroflexed and somewhat prolapsed.

On February 13, 1909, I did a divulsion, a curettage, a trachelorrhaphy, a perinerorrhaphy by the flap splitting method, opened the abdomen and removed a thickened and adherent appendix (see Plate, Fig. 4), and held the uterus forward by the internal Alexander operation. Convalescence was uninterrupted and the patient regained complete control of the sphincter ani. She is to-day enjoying perfect health — the indigestion is gone, the discharges of mucus from the bowel have ceased, and while she is still nervous, not nearly as much so as previously to the operation.

CASE 4. Patient aged 28; two children, both stillborn; vomited during the entire period of uterogestation. Was pregnant on two other occasions but aborted in each instance at the third month. She was a little, frail, delicate woman; was fairly well previous to her pregnancies, although latterly she has been having recurrent attacks of pain in the region of the stomach and abdomen with intense nausea and vomiting. She was becoming despondent, complained con-

stantly of a bearing down sensation and pressure in the region of the sacrum. There was obstinate constipation, with much flatus, dysmenorrhœa with scant flow, and a nasty leucorrhœa. There was no history of specific infection.

On February 16, 1909, I did a divulsion, a curettage, a trachelorrhaphy, removing a large amount of scar tissue, a perineorrhaphy, dilated the rectum thoroughly and overcame extensive adhesions of the clitoris (the organ was entirely concealed). I then opened the abdomen and removed a long, indurated appendix, and did the internal Alexander operation for the purpose of holding the badly retroflexed and prolapsed fundus forward. The patient began to eat within a few days after the operation almost everything she cared to and without the slightest inconvenience. She is now well and strong.

CASE 5. Patient aged 29; has been under my observation at various times for the last 17 years. There was a history of invalidism during girlhood. Dysmenorrhœa from the beginning of her menses; tendency to glandular enlargement; had had several attacks of otitis media with suppuration, which left her quite deaf. Distressing melancholia. The uterus was retroflexed when I examined her more than ten years ago. She had indigestion from girlhood and was always constipated. Large quantities of mucus were not infrequently passed. There had been at least three sharp attacks of appendicitis. One child five years old, at the birth of which she was badly lacerated. An effort was made by another surgeon to repair these lacerations, but union was incomplete.

On October 29, 1909, I dilated the uterus, did a curettage, a trachelorrhaphy, removing a very large amount of cicatricial tissue, built up the pelvic floor by the Emmet method, dilated the rectum, opened the abdomen, removed with some difficulty a very long, thickened appendix, which was postcæcal, and held the uterus forward by means of the internal Alexander operation. She convalesced beautifully, has taken on flesh, her indigestion, constipation, and enterocolitis have disappeared, her hands and feet are warm, whereas they were previously cold, and she is in every way well and happy.

CASE 6. Patient aged 54, a nervous, hysterical wreck, was melancholic, despondent, irascible, unreasonable. Her husband, who is a prominent railroad man, was driven almost to desperation because of her disposition. She had indigestion, was obstinately constipated, and had severe attacks of headache and distressing insomnia; most distressing dysuria. Mucous enterocolitis with frequent attacks of intestinal colic.

Physical examination showed a badly lacerated cervix, hæmorrhoids which completely encircled the anus, bleeding profusely; the anterior vaginal wall projected from the ostium vaginæ, the fundu spressed hard against the rectum, and the pelvic floor was badly relaxed. Blood pressure 170 mm.

On May 11, 1909, I did a divulsion, a curettage, overcame the cystocele by the Wood operation, dilated the urethra, built up the pelvic floor, removed the hæmorrhoids, opened the abdomen, explored the appendix, which was normal, fastened the uterus solidly in front with two catgut sutures, and closed the abdomen in the usual way. It would not be in entire harmony with the truth to say that her disposition is now altogether "angelic." However, she is looking at life through different eyes. She is eating well, sleeps well, and suffers no longer from the local and systemic conditions for which she was operated.

CASE 7. Robert R., aged 19; had had two sharp attacks of appendicitis, the first one three years previously to the operation, and was just recovering from the third when going upon the table. There was marked sensitiveness over McBurney's point and outwards toward the right anterior superior spinous process. Since his first attack he says that he has had indigestion, has been constipated. and passes at times large quantities of mucus.

URINARY EXAMINATION

Transparency	clear.
Color	dark amber.
Reaction	acid.
Sp. gravity	1030.
Sediment	none precipitated.
Urea	2.3 per cent, 10 grs. to oz.
Indican	excess.
Albumen	positive small amount.
Sugar	negative.

MICROSCOPICAL

Very many purely hyaline casts.

A few hyaline casts containing two or three epithelial cells.

Transitional epithelium.

A few renal epithelial cells, granular in character.

A few leucocytes.

A few red blood cells.

A few calcium oxalate crystals.

On June 6, 1908, through a short incision, I took out a postcæcal appendix five inches long, which was thickened and distended with pus. On the fourth day following the operation he became enormously distended and his stomach acutely dilated. I inserted a tube, washed the stomach, and finally got the bowels to move, which relieved the distress. He was a cigarette fiend and begged almost immediately following the operation that I permit him to smoke. He was so persistent in this request that on the sixth day after the operation I indulged him in a limited number of cigarettes. His distressing gastro-intestinal symptoms subsided almost at once and from this time on his convalescence was uninterrupted. He is entirely relieved of his mucous enterocolitis, is eating freely of all kinds of food and has gained 20 pounds in weight. His urinary condition has entirely cleared up.

CASE 8. Patient a beautiful girl, aged 21; neurotic history on paternal side; mother has Bright's. Four months before I saw her she began to have severe epileptic paroxysms. She would froth at the mouth, bite her tongue, fall suddenly, and become very dark in the face. She presented a complete picture of gas-

trointestinal auto-intoxication. Blood pressure 140 mm. There was obstinate constipation, indigestion, cold hands and cold feet, mucous enterocolitis, headache, backache, coated tongue, etc. The appendix was distinctly palpable. She was exceedingly apprehensive, and was at all times fearful of having a recurrence of the spasms. Her abdomen was very sensitive and on several occasions the attacks had been brought on by pressure over the abdomen. Because of the intact hymen I did not try to make a vaginal examination previously to giving the anæsthetic.

On the morning of February 27, 1909, she was wheeled into the surgery to be prepared for operative work. The hospital which she selected had but one large operating room and no anæsthetizing room. It is the custom in this hospital to scrub the patient after being placed on the operating table before the anæsthetic is administered. As another operation was in progress at the time, the patient was exceedingly frightened and had a severe epileptic convulsion while in the process of preparation. It was a question what to do. However, I instructed my nurses to wash her up as quickly as possible and I opened the abdomen, after a few whiffs of chloroform, during the convulsion. I found the appendix indurated and both ovaries small and cirrhotic. The ovaries were removed by tying the vessels individually and closing the upper part of the broad ligaments with a running catgut suture — this to reduce to a minimum terminal nerve impingement. The uterus was found sharply retroflexed and was suspended by the Kelly method. The abdomen was closed in the usual way, after which the rectum was thoroughly dilated and adhesions of the clitoris broken up.

There was not the slightest break in the convalescence. She had a slight spasm during April of 1909. We kept her under small doses of antispasmodic for four months. These were gradually withdrawn and with the exception that she still has to be careful as to what she eats, she is very well. There is more or less apprehension, but she is rapidly acquiring self-confidence. This case is not pronounced cured, as the time is yet too short to justify such a claim. I believe, however, that had she been free from the auto-intoxication the epileptic habit never would have become established. It is interesting to note that the abdominal and pelvic viscera, as well as the peritoneum, were as dark as the face. So far as I know this is the first time the abdomen was ever opened during an epileptic seizure.[1]

CASE 9. Patient aged 40; commenced to menstruate at 13; menses always regular and normal; married at 22; one child when she was 24 years of age: instrumental delivery. At the age of 21 she began to have a severe, burning pain in the stomach which was constant and uninfluenced by the kind of food taken. Test meal, 70 cc. recovered; much thick and ropy mucus; total acidity, 50; volatile acid, 21 per cent; free Hcl., *nil;* protein Hcl., 0.092; mineral Hcl., 0.108. There was also at this time a severe pain in the right side which became localized over McBurney's point; frequent attacks of nausea and vomiting; had an abortion two years after the birth of her child, after which the pain in the right side was much worse. The attacks of nausea and vomiting increased in frequency from one a week to as many as five a week; they always came on in the night between 12 and one o'clock. Obstinate constipation, much mucus in the stools; coated tongue, breath exceedingly foul, burning in the pit of the stomach and under the ribs, aggravated on lying down.

Physical examination revealed both ovaries enlarged, exquisitely tender, and prolapsed. The appendix was distinctly palpable and directed downward toward the pelvis.

On February 21, 1910, I opened the abdomen to find that the appendix was adherent to the right ovary (see Plate, Fig. 5). Both ovaries were removed with the appendix. The appendix contained a fæcal concretion and some pus. Convalescence progressed uninterruptedly and the patient is a changed woman in every way. While she still has to be cautious regarding her diet, the old attacks of pain have ceased and she is 30 pounds heavier than she was before the operation.

CASE 10. Patient aged 35; unmarried. This patient had the characteristic symptoms of gastro-intestinal auto-intoxication, with constipation, nervousness, intense dysmenorrhœa, gastric and intestinal indigestion, and mucous enterocolitis. She was a lady of culture and means and had been all over the world seeking health. The late Dr. Skeen of Brooklyn had her in his sanitarium for six months and curetted her without benefit. This was in 1888. In 1889 she was again curetted and underwent the "American operation." This benefited her in a measure but the good results were not lasting. Then she tried electricity, tampons, douches, etc., for another two years. She was in a measure benefited by this treatment, but only temporarily.

In November of 1899, I curetted and packed the uterus and divulsed the rectum. The abdomen was then opened through a median incision. The appendix was bound down by adhesions and was nearly ruptured at one point. This was removed in the usual way. Both ovaries were irregular, large, prolapsed, nodular, and cystic, and the tubes distended. The appendages of both sides were removed and the uterus fastened in front. Convalescence was without incident and she is now, except that she is exceedingly nervous and always will be, in excellent condition in so far as the gastro-intestinal symptoms and dysmenorrhœa are concerned. She perhaps had more than the usual distress incident to a forced menopause because of her neurotic tendencies.

PATHOLOGIST'S REPORT (CASE 10)

(See Plate, Fig. 6.) Ovaries both enlarged; right ovary 4.2 cm. x 3.3 cm. x 1.5 cm.; left ovary, 4 cm. x 3 cm. x 1.6 cm. The surfaces of the ovaries are uneven and nodular, with numerous cysts showing on inspection. The right tube is 9 cm. long, tortuous, and distended with a thick, creamy pus; the fimbriated

[1] I regret to say that since this paper was written the epileptic seizures, excited by seeing her mother die in a uræmic convulsion, are recurring with their former frequency

extremity much dilated and is entirely sealed off. The left tube is 8 cm. in length, is less distended than the right, and contains only broken down, cheesy material. The abdominal ostium of this tube is closed and the uterine extremity constricted, as is the right tube.

The vermiform appendix is 9.5 cm. in length; a constricting band is noted at its posterior and upper third. Opposite this point and a little below it is seen a distinct bulging of the wall, where it is thinned almost to the point of rupturing; some slight congestion is noted in the course of the appendix.

On incision the ovaries are seen to consist of very little solid tissue, over two-thirds of their total volume being occupied by cysts which are filled with a semi-solid fibrinogelatinous material. Stained sections from both ovaries show the capsule to be much thickened. Sclerosis is marked, there being great connective tissue increase at the expense of the ovarian substance. There are numerous areas of round cell infiltration. The blood-vessels are numerous, with thickened walls; the cysts are lined with a single layer of flat epithelium of the follicle wall; several of the cysts are coalesced with atrophy of the intervening septum. Little or no normal ovarian substance is noted in either ovary.

Microscopic examinations of sections of the right tube show the folds and processes of the mucosa to be hyperplastic and densely infiltrated. This infiltration extends into the muscular and serous coats also. The mucous lining of the tube is denuded of its epithelium and numerous small cysts are formed by the cohesion of its folds. All of the layers of the tubal wall are thickened. Direct examination of the pus from tubes and culture on blood serum and urin agar are negative. Cultures from lumen of the appendix show only the bacillus coli communis. Diagnosis: Double proliferative pyosalpinx with a beginning multiple cystoma of the ovaries.

CONCLUSIONS

1. The most diverse views prevail at the present time regarding the causation, pathology, and treatment of gastro-intestinal auto-intoxication and so-called enterocolitis.

2. The association of the two conditions is frequently observed.

3. A most common symptom of chronic appendicitis is the discharge of mucus per anum because of the enteritis excited and perpetuated by the inflamed appendix.

4. There is increasing evidence going to show that a causal relationship exists between chronic appendicitis, with or without mucous enterocolitis, and gastro-intestinal auto-intoxication.

5. Lesions of the female reproductive organs may also, either by interfering with intestinal peristalsis through direct pressure or reflexly, so interfere with digestion as to cause gastro-intestinal auto-intoxication.

6. In dealing with the symptom-complex of gastro-intestinal auto-intoxication and mucous enterocolitis it is absolutely necessary, in the majority of instances, to have recourse to surgery before permanent relief is obtained. This statement presupposes that intelligent dietetic, hygienic, and medicinal measures have been faithfully observed previously to operation.

7. Relief following surgical work, when indicated, is usually immediate. It may be necessary, however, to keep the patient, especially if neurotic, under observation and treatment for some months following the operation.

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MUSCLE GROUP ISOLATION AND NERVE ANASTOMOSIS IN THE TREATMENT OF THE PARALYSES OF THE EXTREMITIES[1]

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IN a paper read before the American Neurological Association in 1909 with the title "The Surgical Treatment of Athetosis and Spasticities by Muscle Group Isolation" we made a preliminary report of our experience with what we conceived to be a novel method of approaching the problems presented by cases of spastic palsies and athetoses in children. The material upon which this paper was based consisted of four cases, one was a cerebral hæmiplegia with athetoid movements in the forearm and fingers, the other three were cerebral diplegias, usually called Little's disease. This method was designated "muscle group isolation," a term descriptive of a procedure which had for its aim an isolation of a single group, or several groups of spastic muscles, by a surgical attack upon the nerve or nerves directly involved. As our material has grown and our experience increased, the utility of this procedure has extended so that it has included in its application the flaccid paralyses, and the spastic contractures following hæmplegias of apoplectic origin.

At this point it seems of advantage for the purpose of making what is to be said clearer, to set down briefly the fundamental principles upon which muscle group isolation is based. Athetoses and spastic conditions of organic origin are similar processes. Athetoid movements may be regarded as variants of permanent tonic spasticities. They may be said to be due to several factors, the most salient of which is a constantly active set of highly irritative impulses arising from the cortical motor cells. These impinge upon the muscles which are usually in a condition of slight hypertonus. The overaction of the congenitally stronger muscle group as compared to weaker antagonist group causes this temporary state to become permanent, and there results then a characteristic attitude and deformity. The essential mechanism must be thought of as central in origin, meaning that the nerve or nerves supplying the muscle group or groups which is the conducting mechanism and by which this state is produced are the anatomical structures which demand primary attention as the focus of operative measures.

[1] Read by invitation before a joint meeting of the Chicago Surgical Society and the Chicago Neurological Society, May 13, 1910.

As we have advanced in the study of these and allied problems, we have come to believe that definite advance follows a mutual appreciation of surgical and neurological points of view. The neurologist is apt to be concerned with matters pertaining to disturbance of function, the surgeon, on the other hand, with postures typifying end results and expressed in terms of deformity. There is needed, therefore, a clinical nomenclature which not only covers the origin and end results but also the intermediate ground. This includes the more fertile field for therapeutic effort. To accomplish this it is only necessary to express in terms easily understood, the nervous and muscular mechanism through which the clinical picture is produced. For example, in describing the adduction of the thighs seen in cerebral diplegias we have made use of the muscle group involved as well as the nervous agency, thinking of it simply in terms of adductor overaction through the obturator nerve; in like manner in paralytic flexion of the knee, calling it hamstring overaction through the branches of the sciatic. We regard the various paralytic attitudes of the foot in terms of overacting muscles through their nerve supplies.

We have thought it best to divide our clinical experience tentatively into four groups; each of the groups presents a different phase of the therapeutic problem and has for its solution a different application of the method.

Group I. Athetoses and spasticities. Treated by muscle group isolation only.

Group II. Flaccid paralyses. Treated by muscle group isolation and nerve anastomosis.

Group III. Complicated tic movements. Treated by induced paralysis.

Group IV. Spastic conditions following apoplexy.

In the first group we have a total of nine cases operated upon.

1. Cerebral hæmiplegia with athetosis.
2. Cerebral diplegia, Little's disease.
3. Cerebral diplegia, Little's disease.
4. Cerebral quadriplegia.
5. Cerebral diplegia, Little's disease.
6. Cerebral quadriplegia.
7. Spastic hæmiplegia, with slight congenital hydrocephalus.
8. Cerebral diplegia, Little's disease.
9. Cerebral diplegia, Little's disease.

In our preliminary report a description of the methods that have been used in treating this class of cases was given, together with a summary of the recent literature. From these sources and our own experience we gave the causes for the lack of permanent results following tenotomy, myotomy, tendon and muscle transplantation as follows:

These methods, besides being merely an attack upon the end result, have the additional disadvantage of being but transitory in their benefits, the condition being all too frequently re-established. This is due to the fact that the nerve supply, which is the conducting structure by which the abnormal impulses are brought into action, remains untouched. Furthermore, by the necessary supplementary treatment; i. e., plaster-of-Paris bandages or fixation apparatus, not only are the local antagonists made much weaker, but also the whole muscular mechanism of the extremity is seriously impaired by the confinement in bed and the tight bandaging necessary. This criticism holds true for muscle transplantation in spastic cases; in addition the scope of this method is necessarily limited to a narrowly selected group of cases, in which only a single muscle may be utilized. Since working on these problems, two other methods designed for the surgical relief of these cases have been reported: (1) Intraperineural neurotomy, by Dr. John Joseph Nutt.[1] The principles upon which this operation is based appear to us to be unconvincing from the point of view of the physiology of the nervous mechanism which is involved. From a practical point of view there is an evident objection: First, in the actual carrying out of the operation, and second, in the effect of the operation. It would be impossible to perform this operation upon the smaller peripheral nerves, and furthermore the operation ought to be more directly applied to the mechanics of muscle groups which are directly concerned in the production of the paralyses.

The other procedure, based upon an entirely different conception of the whole problem, has been reported by Förster and Tietze.[2] This method consists of resection of the posterior

[1] The American Journal of Orthopedic Surgery, vii, 2, November, 1909.
[2] Zeit. f. Ortho. Chir., October 22, 1908.

spinal nerve roots. Our objection to this method is based upon the following facts: The magnitude and seriousness of the operation, especially in cases of spastic children, is a positive objection to it. Furthermore, the operation is based on incorrect physiologic principles for these reasons: Motor nerves contain sensory fibers which have nothing particularly to do with the posterior roots, so that cortical rest, whatever that might be, could not possibly result from merely posterior root sections. The overlap is so considerable that in order to affect a whole spastic extremity, a large number of roots would necessarily have to be cut. This would make the operation one of inadvisable magnitude in the majority of cases. Furthermore, no matter how many roots were cut no complete sensory paralysis would possibly result. Admitting even that complete sensory paralysis could result, then the very object of an operation of this kind would be done away with, namely, the possibilities of co-ordinated voluntary movement. It is a well known fact that in absolutely anæsthetic areas no properly co-ordinated movement can ever be possible.

The chief object of treatment in all cases of spasticity is to enable the patient to make properly co-ordinated movements, with the mechanical disability caused by spasticity rendered as ineffective as possible. The spasticity as such is scarcely the main object of treatment, for the reason that its origin, nature, and localization is still a matter of great obscurity. To assign it to the cortex of the brain is neither justified by facts nor upheld by any well known theories.

OPERATIVE PROCEDURES

Four operations have been performed on spasticities.

The first of these consists of isolating and injecting with alcohol the obturator nerve at its exit from the pelvis. This nerve supplies the gracilis, the abductor brevis, the abductor longus and sometimes also (partly) the pectineus, the hip joint capsule, the adductor minimus, and the main portion of the adductor magnus. It arises from the second, third, and fourth lumbar nerves and is the only nerve of the plexus that emerges at the medial border of the psoas, behind the common iliac vessels. It runs forward and downward to the obturator canal. It traverses this canal, giving off muscular branches to the obturator muscles, and immediately after making its exit it divides into two branches: An anterior, or stronger, which supplies the adductor longus and brevis and a posterior, or weaker, which supplies the hip joint capsule and adductor magnus. The nerve is principally a motor nerve though it contains some sensory fibers.

An incision 2 inches long on anterior aspect of thigh, running vertically, beginning at Poupart's ligament one-half inch inside its middle point, carried downwards through subcutaneous fat to fascia covering the adductor group of muscles. Fascia divided by dissection and the internal border of the adductor brevis and longus made out, opening carried down to pectineus fascia at horizontal ramus of the pubis. This is divided in line of incision and retracted. The obturator nerve is discovered issuing from below the horizontal ramus of the pubis at the upper extremity of the wound. It divides at this point into two terminal branches. Above this division the trunk of the nerve is seized with blunt dissecting forceps and drawn upwards into the wound. At this point it is injected with an alcoholic solution.

The second planned for the relief of overaction and spasticity in the hamstring groups. Here, the nerves to be attacked are the branches of the great sciatic which supply the hamstring muscles; i. e., the biceps, semimembranosus, and the semitendinosus. These branches are given off of the trunk of the great sciatic in the upper half of the thigh.

Vertical incision four inches long over the course of the great sciatic nerve, nerve exposed and branches isolated, their identity determined by the use of a sterilizable electrode and faradic current. This feature is of especial importance and requires considerable care and observation. When the branches are thus isolated they are easily injected with alcohol with a fine needle from the ordinary hypodermic syringe.

The third operation planned for the relief of overaction of the gastrocnemius group. The muscles here involved are mainly the gastrocnemius and soleus which are enervated by branches from the internal popliteal nerve.

Incision two inches long made longitudinally over the center of the popliteal space, carried downward through the fascia between the two heads of the gastrocnemius to the internal popliteal nerve. The branches which enervate the soleus and gastrocnemius are isolated by careful electrical stimulation and injected with an alcoholic solution.

The fourth operation is designed for the relief of spasticity affecting the anterior tibial group through its enervation from the anterior tibial nerve.

Through a longitudinal incision one and one-half inches long over the head of the fibula the external popliteal nerve is easily exposed at its bifurcation into the peroneal and anterior tibial nerves. It is best to identify the nerves by a careful electrical stimulation, and the anterior tibial is then injected with an alcoholic solution.

The first three cases in the above list were reported in detail in our preliminary paper (The Surgical Treatment of Athetosis and Spasticities by Muscle Group Isolation, Schwab and Allison, Journal of Nervous and Mental Disease, vol. xxxvi, No. 8, August, 1909).

CASE 4. C. D., 12 years of age, December 19, 1908. Cerebral quadriplegia. General condition of paralysis noticed shortly after birth. Has made little progress mentally though he understands simple questions and is able to form single words intelligently. Has never walked. General condition has been good. Family history good except that mother had a form of facial paralysis. Examination December 19, 1908, showed a well developed and fairly well nourished boy. Intelligence that of a child of three years of age. No deformities of skeleton. Nothing abnormal about abdomen or thorax. Because of automatic movements of lower muscles of face he has peculiar grimaces and foolish expressions. Spine normal. Upper extremities spastic from tips of fingers to shoulder joints; lower extremities held in marked adduction, knees crossed, legs flexed on thighs 45 degrees, foot in position of slight dorsal flexion and toes plantar flexed. Spasticity of adductor groups is very marked, resisting attempts at passive correction. The knees cannot be extended beyond 20 degrees flexion. Hamstring groups are particularly spastic and contracted. Attempt at passive movements at ankle joints brings on spasticity, expecially in extensor groups and the foot is moved into slight dorsal flexion with toes plantar flexed, the great toe overlapping the two next to it. In the feet and hands are automatic movements similar to those described in the face. Standing position: Can almost maintain balance, weight is borne on internal borders of feet not including heel with legs crossed, the left knee anterior to the right knee; the right knee resting on the calf of the left leg, flexed 45 degrees. Thighs flexed on trunk 35 degrees. Trunk fairly erect, the arms are engaged in many excited movements in the attempt to maintain balance. In attempting to walk both legs are rapidly moved by automatic irregular movements of two sorts, described as a movement of attempted progression which are corkscrew in character and are produced voluntarily. During this attempt the boy's face is contorted and his arms are very spastic, the whole being accompanied by foolish laughter, grimaces, and inarticulate sounds.

December 21, 1908. Operation, ether, through the incisions described above the obturator nerves were exposed on both sides without difficulty, and injected with an 80 per cent solution of alcohol. It was found immediately after this operation that both thighs fell into a position of abduction. Recovery good.

December 26, 1908. Boy has had no temperature. Thighs are abducted 15 degrees and there is no spasm in the adductor groups. General condition good.

December 29, 1908. Operation, ether, wounds of first operation found to be healed, except for a small space at the lower end of the incision on the right side, which has granulated. Stitches removed. The patient turned on face, posterior aspect of both thighs prepared for operation. Anæsthetic administered. Knees held tightly flexed at 50 degrees flexion. Through a two and one-half inch incision, running downward from the fold of the buttock over the course of the sciatic nerve. This nerve trunk was exposed by blunt dissection on the right side first. The branches giving off to the internal hamstrings first discovered and injected with 60 per cent alcohol. Later the branch to the biceps picked up, also injected. Spasm of the hamstring has diminished so that toes touch the table, a marked contrast in spasticity between the right and the left. Same procedure employed on the left side with a similar result. Wounds closed with silver wire subcutaneous stitch. Good recovery. It is now found that the lower extremities are abducted 20 degrees and flexed at the knee 15 degrees instead of 50. It is to be noted when the patient was recovering from his anæsthetic that he was able to slightly abduct both thighs.

January 5, 1909. Patient's wounds have united by first intention, general condition good, boy is able to stand and co-ordination is markedly improved.

April 29, 1909. Patient bears his weight upon his legs with knees slightly flexed. He steps decidedly and slowly and a tendency to overaction is much diminished. Co-ordination in arms and legs has decidedly improved.

CASE 5. N. G., 12 years of age. Cerebral diplegia, Little's disease. At the age of nine months the child had scarlet fever, and parents date his trouble from that time. He learned to walk slowly and his intelligence has been only fair. Patient gets about with assistance but has a cross-legged gait. Well developed and fairly nourished boy, head square and large, expression dull, intelligence good, can spell, write, and do simple sums of arithmetic, heart and lungs normal, upper extremities normal. Lower extremities are spas-

tic, held in 20 degrees abduction with right knee advanced over left, spasticity of hamstrings causing 20 degrees flexion at knees. These contractures can be overcome to a certain extent by pressure and force. Knee jerks abnormally increased, Babinski sign present on both sides, Achilles jerk plus. Gait: By holding to a chair or table boy can travel around same, doing so with a marked spasticity of lower extremities, evidenced by adductor contraction, flexion at the knees and eversion of the feet. The right knee is first held in front of the left and an attempt is then made by swinging the trunk to advance the left knee which is done slowly and with difficulty.

June 15, 1909. Operation, ether, incision made on the right side over the anterior aspect of the thigh at the internal borders of the adductor muscles, carried down through the superficial fascia, muscles made out and an attempt was made to discover the obturator nerve and its exit into the ramus of the pubis. After one and one-half hours' time, this search was unsuccessful and the wound was closed. The nerve was considered to have either an abnormal course or to be undiscovered by the operator. At all events it must have received some surgical injury, for the thigh at the end of the operation was abducted 30 degrees and there was very little spasticity in the adductor group. Recovery good.

June 19, 1909. Operation on left side, ether, incision was made in the usual manner and the obturator nerve was exposed in less than ten minutes' time, having a normal course. Was injected with 80 per cent alcohol and electrical stimulation was employed to make out its conductivity. After the injection this was found to be lost, a strong faradic current being used threw the other muscles of the thigh into a state of tetany which lasted twenty minutes. Wounds closed with s. w. g. Recovery good. Operative wound at first operation healed by first intention. After recovering from the anæsthetic it was found that both thighs were in a position of 30 degrees of abduction, no spasm of the adductor muscles on either side.

July 15, 1909. Operation, ether, secondary operation done on the right side. The obturator nerve discovered after some difficulty. Injected after the usual manner and the usual result. Wound closed with s. w. suture. Good recovery.

July 22, 1909. Operation, ether, patient placed prone upon the table, back of thighs prepared for operation. Longitudinal incision made over each thigh, four inches long. Sciatic and its branches readily exposed. Each branch was picked up, stimulated with mild faradism to find out what muscle or muscles it supplied. Injected with alcohol and conductivity retested. This procedure was done on the branches to the biceps, the semimembranosus and semitendinosus, and a branch to the abductor magnus. Wounds closed with s. w. Good recovery. Two hours after the operation no spasm of hamstrings. Complete extension of the leg is voluntarily possible. Wound of second operation on right side shows primary healing.

August 1, 1909. Leaves hospital, gait improving daily.

September 29, 1909. Boy is going to school, legs still weak but uses them well, feet placed squarely on floor, no tendency to adduction or flexion deformity, is having daily training. Walks alone without support and gait is improving.

Case 6. L. F., 13 years of age. Cerebral quadriplegia, October 1, 1909. Mother states that child walked normally until the fifth year when she had a fright and a fall and was injured by a horse. Following this there was progressive loss of power in her legs, so that when she was 7 years of age she was no longer able to stand or walk. Her hands then became involved so that she could not use them. Her mental condition has remained about the same. She is able to understand her mother and to make attempts at speech. When asked to sit up she endeavors to do so. During the last year she has had several epileptiform attacks with loss of consciousness. She has grown normally and her general health has been good. She has control of bladder and rectum, and has good appetite, sleeps well, and is of a pleasant disposition. Well developed and fairly nourished girl, imbecilic, drolling expression, intelligence that of a child of 5 or 6 years. Is unable to stand, to walk, or to use her arms, on account of spastic contractures. As the patient lies in bed the legs assume position of flexion at the knees, flexion at the hip, with the spasticity more marked in the left than in the right. The adductor spasm can be seen best when the legs are forcibly abducted. Owing to the contracture at both knees the overadduction is not so clearly in evidence. The right foot is in extreme pronation with extension in the three outer toes; athetoid movements present. The left foot is in marked supination. The calf muscles feel soft and flabby in spite of their evident spastic contractures. This is due probably to the fact that the muscles have never been used for walking. There is a shortening of the Achilles tendon in both legs, likewise of the flexors at the knees. Owing to the contracture and the spastic condition surrounding the joints the knee jerks could be obtained only with difficulty and were pathologically plus. On account of the mental condition of the child no attempt at sensory examinationt was made.

October 2, 1909. Operation, ether, excision made over the external popliteal nerve on left leg. Nerve discovered without difficulty and its bifurcation into the anterior tibial and musculocutaneous made out. By an electrode these nerves were positively determined. The anterior tibial on this side was injected with 60 per cent alcohol and its conductivity tested; found to be lost. On the right side the same procedure was put into effect, with the difference that the musculocutaneous was injected instead of the anterior tibial. Through two long vertical incisions on the back of the thighs the sciatic nerves were laid bare and the branches to the hamstrings were injected. Wounds were closed; good recovery. After the operation it was found that the right foot had no longer peroneal spasticity. The left foot is held in clubbed position but not due to muscular overaction. The spasm of the hamstrings has completely disappeared.

October 5, 1909. At 2:00 A. M. patient died of double pneumonia, with a temperature of 109 degrees.

CASE 7. Spastic hæmiplegia, with slight congenital hydocephalus. A. A., 3½ years of age, April 9, 1908. Child is one of five children. Was born when mother was 41 years of age. Instrumental delivery was necessary which left a scar upon the forehead. Child was nursed at breast but has always been weak. Dentition normal. Walked at the age of one and one-half years. It was then noticed that child limped with right foot and held right arm in a peculiar way. This condition has increased since. Mentality is above the average and her general health has always been good. First consultation showed a large flabby child with good mentality. On right side of forehead is a scar from instrumental delivery. Heart and lungs are normal. Expression slightly stupid. Head large and of hydrocephalus appearance. The right foot is held in supination and plantar flexion, the tendon Achilles contracted. There is a slight contraction at the knee. The gait is that of spastic club foot.

Treatment, April 20, 1908. The tendon Achilles was divided and the foot was placed in a right angle position in plaster-of-Paris. Child made a good recovery and after three weeks walked with very much improved gait. Observation has extended over the period of time between this operation and the present.

October 4, 1909. The spasticity in the whole right extremity has returned. There is overaction of anterior tibial and gastrocnemius groups in the right foot and 20 degrees flexion at the knee, due to spastic hamstrings. There is a slight tendency to spasticity in the left lower extremity. Child's general condition has improved, health is good and she walks about in a lively manner but with this disability. Reflexes increased more on the right. The contractures can be overcome by steady pressure; that is, the knee can be straightened and the foot can be brought to a right angle, straight position with the legs but no further.

October 11, 1909. Operation, chloroform, with patient on face. A longitudinal incision was made on the posterior aspect of the thigh, laying bare the upper half of the great sciatic nerve. The branches to the semimembranosus, semitendinosus, and abductor magnus were injected with 60 per cent alcohol, also the branch to the biceps. Incision closed with subcutaneous silver wire stitch. Over the popliteal space a longitudinal incision was made which laid bare the branches of the internal popliteal nerve which enervate the gastrocnemius and soleus; three in number. Electrical stimulation was employed to identify these nerves. Sixty per cent alcohol was injected into their sheaths. Incision closed with subcutaneous silver wire stitch. Through a longitudinal incision over the head of the fibula the external popliteal nerve was exposed and its bifurcation into the musculocutaneous and anterior tibial nerves made out. The anterior tibial was injected with alcohol and the wound closed with subcutaneous silver wire stitch. Time of anæsthetic one hour. Recovery good.

October 15, 1909. Discharged from hospital, all wounds healed by first intention, no temperature.

March 14, 1910. Spasticity of hamstrings has entirely disappeared. There is still overaction of the anterior tibial group, also of the gastrocnemius. This is attributed to faulty technique. A secondary operation is planned.

CASE 8. Cerebral diplegia, Little's disease. D. L., 6 years, 11 months, October 20, 1909. Seen first on October 13, 1905. Family history is negative. Child was born prematurely; weight four pounds. At the time of first observation child was 27 months old. Has been under the care of a doctor for malnutrition and has gained weight and strength. Child is able to speak a few words. Spasticity was noticed in the right arm and leg. The mental development has been below normal. Says "mamma," "sister," and "papa." Weight 23 pounds. Examination showed spasticity in legs, more marked in the right, with plus knee jerks, no clonus, no Babinski. The legs are freely movable as are likewise the arms in passive motion, but a spastic condition develops and is easily observed. The child is only able to hold its head up for a moment; cannot stand unless supported. When held up the legs become adducted in a cross-legged position.

Seen again at three years of age, November 9, 1906. Patient is not able to stand, attempts to rise up in a sitting position with more vigor than at the last examination.

November 9, 1906. Well developed and well nourished child. Back weak, both legs spastic, and arms spastic. Overaction of both tendon Achilles and hamstring groups.

November 10, 1906. Operation, ether, both tendon Achilles divided subcutaneously, feet confined at right angled position with legs in plaster-of-Paris bandages. Recovery good. To be supplied with ankle braces and jacket.

November 25, 1907. Sent home. Mother instructed to encourage child to take the initiative in walking and using his muscles.

May 19, 1908. Seen in consultation with Dr. E. H. Bradford of Boston. Child walks with feet on floor, slight pronation, slight flexion of toes, stands with support requiring aid in balancing. Back is still weak, sits erect for a few seconds with head correctly posed, but relaxes and falls forward. There is marked spasm of the adductor groups of muscles and slight spasm of the hamstrings. Advised to discontinue braces and have child associate with playmates and be educated in attempting to walk.

September 27, 1909. When placed on his back child makes a good attempt to rise by flexing the whole body at an angle of 20 degrees. The spasticity in the lower limbs is very evident. There is marked adduction spasm, producing cross-legged position. Child is able to stand with support. The feet are flat on the floor and there is no spasticity in the gastrocnemius group. He can sit alone with spine flexed in a long posterior curve, the head held fairly erect. Mental condition markedly improved, general nutrition good. Parents advised to bring child to the city for a period of six months.

October 20, 1909. Operation, ether, through two incisions over the anterior aspect of both thighs at the usual point the obturator nerves were easily found and

isolated. Injected with 80 per cent alcohol. Time of operation 40 minutes. Child's condition after operation good. Legs abducted to 50 degrees, spasticity of adductors has entirely disappeared.

October 29, 1909. Patient discharged from hospital. Wounds healed.

January 1, 1910. Child has been doing systematic daily physiologically planned exercises with massage. There has been marked improvement in initiative. He now attempts to make steps. Supports himself in standing and all tendency to adductor deformity has disappeared.

April 1, 1910. Educational exercises have been continued daily. Child is now able to make certain voluntary movements and to hold himself upright in sitting. As yet he is unable to balance or to stand alone.

CASE 9. Cerebral diplegia, Little's disease. M. M., 2½ years of age, March 17, 1910. Birth was normal and child presented normal appearance. As it became older mother noticed that lower limbs were held stiff. Mentality has been slow in its development. Can say only a few words and expression is vacant. Has never made any attempt to walk but can stand with slight support. Well developed and well nourished child, marked spasticity of both lower extremities, legs held adducted. When child is placed upon its feet the spasm of the adductor muscles and of the gastrocnemius groups is very marked, producing cross-legged flexed knee position.

March 17, 1910. Operation, ether, through an incision over the anterior aspect of thigh, just below Poupart's ligament, the obturator nerve was easily discovered and isolated on both sides. Into them was injected 60 per cent alcohol. This was followed immediately by loss of conductivity demonstrated with the electrode, and by the thighs assuming an abducted position. Wounds closed with silver wire subcutaneous sutures. Recovery good.

March 30, 1910. Wounds healed by first intention, child leaves hospital in good condition. All tendency to adductor deformity has disappeared. There is no spasm of adductor groups; gastrocnemius group slightly overactive, also hamstring. Mother instructed in physiological exercises.

In summarizing the results obtained in this group of cases it is necessary to point to the fact that we are dealing with a class of congenitally defective individuals, so far as the nervous system is concerned, and that the results of operative procedures must be given in terms of improvement only. Furthermore, the mortality following operation is due to the lessened resistance characteristic of the congenitally defective; for example, the two cases that resulted fatally (case 2 and case 6) died of double lobar pneumonia, though the operation was in neither case prolonged or productive of shock. With this explanation in view we believe the following results are a just estimation of the effectiveness of muscle group isolation in the treatment of spasticities.

One case of cerebral hæmiplegia with athetosis, athetosis stopped, paralysis unaffected.

Four cases of cerebral diplegia (Little's disease), markedly improved. One of these to the extent that walking and co-ordination are practically normal; two cases relieved of cross-legged progression and put into a position where the proper educational exercises will develop a co-ordinate gait; the fourth relieved of adductor overaction and still under treatment.

One case of quadriplegia, very extensive in character with extreme overaction of stronger muscle groups. Standing impossible. This case after operation was able to stand and has since made considerable improvement under properly designed exercises. Walking has not yet been accomplished without support.

One case of spastic hæmiplegia with slight congenital hydrocephalus in which there was overaction of the hamstring group, the gastrocnemius group, and the anterior tibial group. Here, the operation was effective in overcoming the overaction of the hamstrings. The overaction of the gastrocnemius group, due to faulty technique, has not been checked, but the gait is much improved.

Two cases died after their operations from pneumonia.

GROUP II

In the second group we have a total of four cases operated upon.

1. Traumatic paralysis of musculospiral.
2. Poliomyelitis anterior. Paralysis of quadriceps extensor.
3. Poliomyletis anterior. Peroneal paralysis with overacting anterior tibial group.
4. Poliomyelitis anterior. Peroneal paralysis with overacting anterior tibial group.

The first two cases in this group are reported to show the efficiency of nerve anastomosis properly performed, and have their bearing upon the problem under consideration in that nerve anastomosis serves an important purpose in carrying out an essential step in an operation of which muscle group isolation is the complement. This operation was used in cases 3 and 4 of this group. In them the an-

tagonist group overacting at the expense of the flaccidity paralyzed group produced deformity. Nerve anastomosis alone would have been insufficient unless the unequal pull had been rendered powerless by temporarily throwing the overacting muscle out of activity. This was accomplished by alcoholic injection of the nerve supplying this muscle group.

CASE 1. Traumatic paralysis of musculospiral. T. T., 21 years of age, June 16, 1909. On February 17th he was riding in the doorway of a caboose attached to a lumber train. The door was open and of a sliding character, leaning out of the doorway, his right arm and right leg over the sill. The train struck a boulder and came to a sudden stop, throwing the sliding door against his right arm and right thigh, fracturing the femur and injuring his arm. Well developed and well nourished young man, heart and lungs normal, general physique good. Right femur: Small discharging sinus on inside of thigh, union good with deformity. Right arm and forearm: There is a characteristic wrist-drop, lack of power to supinate, lack of power to extend the wrist, typical musculospiral palsy. The biceps muscle apparently crushed in two, one-third of it forming a prominence just above the elbow joint, the upper two-thirds retracted for one inch above the middle of the arm. Triceps power and brachialis anticus power good. The divided ends of the biceps are also enervated. The humerus is uninjured. There is considerable wasting of the muscles of the forearm and shoulder.

June 17, 1909. Operation, ether, a longitudinal incision was made over the posterior external aspect of the arm, carried down between muscular septa to musculospiral nerve. Just below the groove there is a thickening in the nerve. Electrical stimulation applied along the course of the nerve causes contraction of the brachialis and triceps. No response in muscles of the forearm or wrist. Sheath of the nerve freed and the wound closed with interrupted s. w. g. sutures. Ruptured biceps sutured with animal tendon.

June 3, 1909. All the wounds have healed by first intention. Electrical stimulation (faradism) produces no reaction either in nerve or muscles on the extensor side of the arm.

July 7, 1909. Patient is up and about and examined daily with electricity to discover any tendency towards re-establishment of nerve function. Up to the present time there has been no improvement. Biceps united.

July 13, 1909. Operation, ether, incision was made over the course of the musculospiral nerve, following line of former incision, carried anteriorly over the elbow joint down to the muscles. The musculospiral nerve exposed; does not respond to direct electrical stimulation. It was divided in its middle for a distance of three inches longitudinally and the inner half cut free at the upper extremity of the longitudinal cut. This segment carried under the biceps tendon and inserted into the median nerve and sutured in place with 00 catgut. Wounds closed. Through a longitudinal incision over the dorsum of the forearm the extensor tendons of the wrist were shortened, placing the wrist in extreme extension. Both wounds closed with silver wire subcutaneous stitches. Plaster-of-Paris applied holding forearm flexed, hand extended. Good recovery.

July 23, 1909. Plaster removed. Wounds have healed by first intention. There is absolutely no power of extension of the wrist or fingers. Patient supplied with a tin splint which can be applied to the arm, holding the forearm flexed and the wrist and fingers extended. There is no reaction to faradism in nerve of muscle.

November 11, 1909. Patient can hold wrist extended and use his crutch on that side with very little difficulty. Examination of the muscles supplied by the musculospiral nerve: There is only a minimum amount of paresis at the wrist. The hand is held almost horizontal with a slight indication of wrist-drop, produced largely by fatigue. There is a definite extension movement at the wrist and fingers. This movement can be observed with the arm flexed at the elbow. The extension at the elbow is good, as it has always been. Stimulation of the musculospiral at the usual place over the triceps muscle gives a slight reaction of the triceps. Below the injury, however, galvanism of this nerve produces no response. Galvanic stimulation of the extensor group of muscles gives a very definite response in the middle finger and to a lesser extent in the other fingers. This extensor response can be shown by the movement of fingers and by the actual movements of the tendon and by palpation as well. It seems from this examination that the extensor response at the wrist and at the fingers has returned and the conclusion is justified that the anastomosis of the median and the paroxysmal part of the musculospiral has been to this measure successful.

April 27, 1910. The forearm is held pronated, and there is some disability in supination. There is considerable power in extending the wrist and extending the fingers. At the site along the anatomical course of the musculospiral nerve strong faradism gives only transmitted effect on the flexor side of the hand, forearm, and wrist. There is no extensor response whatever. Over the site of the anastomosis, at the median surface of the arm, along the inner border of the biceps, stimulation with a light faradic current gives prompt extension of the fingers, thumb, and wrist. Stronger current here produces an additional normal flexion. This demonstrates that impulses along the extensor tract in the arm are transmitted through the median nerve and that the remnant of the musculospiral reacts no longer to electrical stimulation. There is normal ability to use the hand and forearm.

CASE 2. Poliomyelitis anterior. Paralysis of quadriceps extensor. W. W. K., 6 years of age, November 13, 1909. Eighteen months ago boy had a typical attack of poliomyelitis from which he recovered so that he could walk in about a week. General physical condition good, mentality is above the average. Heart and lungs are normal, skeleton normal except for one-half inch shortening of right lower extremity. Muscu-

lature is normal except right lower extremity. Here there is absolute loss of power in the quadriceps extensor. The sartorius has power, the adductors are normally strong, and there is some power in the abductors. Hamstring group weak but active. All muscles in right leg are functionating but weak. There is power to extend and flex the foot on the ankle, also to supinate and pronate the foot. He walks by swinging the right leg on the right thigh with a slight limp, characteristic of quadriceps extensor paralysis.

November 16, 1909. Operation, ether, longitudinal incision made over the anterior aspect of thigh in line of femoral vessels, four inches long, anterior crural nerve exposed. The branch running to the quadriceps group picked up by electrical stimulation. This branch was cut off from the main trunk high up in the wound, passed under the nerve, artery, and the vein. The obturator nerve was then exposed and the branch of the anterior crural was introduced into a longitudinal cut in the trunk of the obturator nerve and there sutured with two strands of 00 catgut. There was no tension upon the anastomosis. The wound was closed with a deep catgut suture and a silver wire subcutaneous stitch. Good recovery.

April 24, 1910. The quadriceps extensor is faradically excitable, both at the motor point and in the course of the muscle itself. There is a visible and palpable contraction of the patella. Power is not yet sufficient in the quadriceps to hold the leg extended on the thigh against the force of gravity, but in walking there is marked improvement in gait, the swing of the leg on the thigh being very much lessened.

CASE 3. Poliomyelitis anterior, peroneal paralysis with overacting anterior tibial group. E. S., 9 years of age. Has always been a healthy child, except for trouble of her left lower extremity. Two years ago without apparent illness, so far as her parents' observation extended, she lost the use of her entire left extremity. It was slightly painful and tender. After a time muscular power began to reappear.

April 30, 1909. Muscles are all good except in left lower leg, where the peronei, with the exception of the peroneus tertius, are powerless. In walking the foot is held in marked supination. The plantar fascia is contracted as is the gastrocnemius. The anterior muscles of the leg, i. e., tibialis anticus, extensor communis digitorum, and the peroneus tertius have fair power. The peroneus longus and brevis do not act. All the other muscles of the leg are normal. There is one-half inch atrophy of calf.

May 3, 1909. Operation, ether, incision made three inches in length, vertical in direction, over the outer aspect of the leg, having its middle point opposite the head and neck of the fibula. This was carried to the muscular layers and the external popliteal nerve was exposed in the wound. Faradic stimulation of this trunk caused a quick contraction of the extensor communis digitorum, tibialis, anticus, and the peroneus tertius. The nerve was further exposed and its bifurcation into the anterior tibial and musculocutaneous made out. Faradic stimulation of the musculocutaneous, one-half inch below the bifurcation, produced no response whatever in the peroneus longus and peroneus brevis. Stimulation of the anterior tibial nerve, one-half inch below the bifurcation, produced a similar strong contraction to that described above. It was then noticed that the musculocutaneous contained no active nerve fibers. This nerve was divided one-fourth inch below the bifurcation with a sharp knife in a longitudinal direction. This cut end of the nerve was then inserted in a vertical slit made in the anterior tibial nerve, one-fourth inch below the bifurcation and was sutured with two strands of 00 catgut. One-half inch below this nerve anastomosis in the course of the anterior tibial nerve, 10 minims of 80 per cent alcohol were injected into the sheath of the nerve. Faradic stimulation of the anterior tibial nerve gave no response in the group of muscles which it supplies. The wound was closed with silver wire subcutaneous stitch. Recovery good.

May 10, 1909. Wound healed by first intention.

September 17, 1909. Child has had electrical stimulation since last note. Foot examined this morning shows power to abduct, using the peronei to a noticeable extent.

November 13, 1909. The foot is held in a much improved position with the outer edge fairly well raised. Voluntary motion is restricted to slight movement and extension in the toes. There is slight movement of the outer edge of the foot. Tibial group is active. Stimulation of the musculocutaneous nerve by galvanism gives a response which can be seen and felt by the movement of the peroneal tendons.

CASE 4. Poliomyelitis anterior, peroneal paralysis with overacting anterior tibial group. B. ML., 8 years of age, May 20, 1909. At two years of age had indefinite history of an attack of paralysis. Since then both legs have been involved. Has had various forms of treatment but not of an operative character. Well developed and well nourished girl. General health good, trunk and upper extremities normal. Right thigh abducted 10 degrees, flexed 10 degrees, 15 degrees of flexion of leg on thigh, foot held in marked plantar flexion and supination. Left thigh flexed on trunk 40 degrees, abduction 30 degrees, externally rotated 50 degrees, marked shortening of psoas and iliac tibial band, leg flexed on thigh 25 degrees, foot in marked plantar flexion and slight inversion. Muscular power: Hamstrings on right side strong; on left side weak, but have power. Quadriceps extensor on right side weak; on left absent. Gastrocnemius group, right side strong; left side power absent. On the right side, there is some power in tibialis anticus and extensor longus hallucis. The peronei on both sides show no muscular power. There is a slight power of dorsal flexion and of extending the great toe. The left foot shows no power in the anterior group of muscles, in the peronei, or gastrocnemius group.

May 21, 1909. Operation. Considering the completely paralyzed condition of the left lower extremity, it was decided to place this limb in a corrected position by division of tendons, delaying operative interference until deformity is corrected. Upon the right side considering the pull of the anterior group of muscles and the

lack of power in the opposing group it was decided to attempt a nerve anastomosis and a blocking-off of the relatively stronger group by an alcoholic injection similar to that which was done in case 3, with variation. An incision was made similar to that in case 3, carried down to the muscles and the external popliteal with its two divisions (anterior tibial and the musculocutaneous) were exposed. Stimulation of the musculocutaneous caused no peroneal contraction; stimulation of the anterior tibial caused contraction in the anterior group of muscles. Peroneal group of muscles were pale and atrophied, but did not show any evidence of degeneration. The musculocutaneous nerve was split for a distance of one-half inch longitudinally in its course and one-half inch below the bifurcation of the external popliteal. A cut was made horizontally at the upper end of this split, and half of the nerve fibers were turned to the inside. A slit was made in the anterior tibial nerve opposite this nerve division and severed end inserted and sutured with a fine catgut suture and the wound closed over the anastomosis with a second fine catgut suture. Below this anastomosis, on the anterior tibial nerve, an alcoholic injection was made into the nerve sheath. This immediately produced a relaxation of muscles supplied by the anterior tibial nerve, allowing correction of the deformity. Wound was closed with silver wire suture. Tendon Achilles was divided subcutaneously, the limb incased in plaster-of-Paris, with the foot in a corrected position. Good recovery.

November 13, 1909. Strong faradism over the site of the external popliteal nerve produced in the peroneal tendons a weak contraction. Also there is some ability to evert the foot. This, however, is very weak, and is overpulled by the anterior tibial muscles as well as by the tibialis posticus.

In summarizing the methods used and the results obtained in the second group of cases, attention is called to the absolutely favorable results which followed simple nerve anastomosis, illustrated in cases 1 and 2. These results re-enforce the idea upon which the combination operation is based; that is, in order to have an effective transference of nerve impulses from a sound nerve to an injured nerve the opposing factor of antagonist muscle pull must be eliminated (this has long been recognized). Furthermore it is essential to point out emphatically that the good results reported in the literature obtained through the agency of tendon transference and elongations serve to strengthen the plan of operation which has been done in cases 3 and 4. Given the amount of power which would insure a good result by any mechanical method whatever, a much more perfect result may be obtained by a proper conservation of the muscles and tendons intact, and a utilization of nerve anastomosis plus properly applied muscle group isolation. Cases 3 and 4 illustrate this point.

GROUP III

In the third group we have one case to report. It is illustrative of the wide extent to which the method of induced paralyses can be applied. It further illustrates the fact that the total nerve supply of a segment of the body, including both sensation and motion, can be cut off by means of nerve alcoholization without subsequent trophic disturbance.

CASE 1. J. H., 32 years of age, family history negative in respect to his present trouble. About eight years before first observation the patient, who was working in a brush factory, noticed jerking movements in his left arm and hand. These jerking movements at first were comparatively infrequent in the course of the day but later increased in extent and in variety until work was impossible for him. For the past three years he has been unable to do any work.

November 2, 1909. There is peculiar and complicated group of movements, limited largely to his left side; that is, to the whole of the left arm, to the shoulder, and to the neck muscles on the left side. The origin of this movement is vague, and, perhaps, has had something to do with his former trade — that of a brush maker. The movements so duplicated the physiological arrangement of cortical muscles in the arm that a temporary diagnosis of Jacksonian epilepsy was made, the diagnosis being based largely on the successive groupings of the movements of the arm. This movement, which we have come to believe is now a tic, is somewhat as follows:

In the first place the movement, to a certain extent, is under the control of the will; that is, it can be started apparently by the patient himself, but once begun he seems unable to control it. The movement begins by an extension of the fingers and thumb, and is followed by flexion of the wrist, by a contraction of the extensors of the forearm, by which the hand and arm are thrown clear of the body. At this point the flexed hand is seized by the right hand and forcibly extended. With this forcible extension of the wrist the whole arm becomes a bit stiffened from the elbow down, and is thrown by the right arm away from the body. The muscles of the upper arm and shoulder now engage in the movement and the arm is finally brought at rest, adducted, and flexed at the elbow and at the wrist. The movement is performed quickly, sharply, and accurately, never varying in the slightest, occupying 30 seconds to a minute or a minute and a half. There is never loss of consciousness, there is no pain or discomfort in the movement. When the movement was first observed, the muscles of the neck, the deep muscles, and the sternocleidomastoid were not concerned. These have lately been involved and there has been quite marked rotation of the neck with the chin to the left and intense

muscular spasm. When the patient was first seen the diagnosis lay between Jacksonian epilepsy and a complicated tic. An effort was made at training the patient.

Then an operation was done over the right cortical area on the chance that there might be some cortical source of irritation. At this operation a large flap was made through the middle of which the rolandic area was laid bare. With a mild faradic current the area of the fingers and thumb and the forearm were picked out to determine accurately the location of the motor center. After the dura was opened, nothing abnormal was discovered, except a group of markedly tortuous veins, practically varicosities, lying at the upper limit of the rolandic area. These were ligated. The patient's arm was enclosed in a plaster-of-Paris bandage after the operation, and as long as the plaster bandage was intact the tic movements were not observed. Shortly after the plaster dressing was removed, however, the movement returned with much of its former severity. The diagnosis now seems undoubtedly that of tic. As an additional argument in favor of this diagnosis can be cited the fact that the patient seems to be more comfortable after the movement takes place and seems rather expectingly waiting the impulse, whatever it may be, for the movement to take place.

October 21, 1909. Operation, ether. Through a median incision over the belly of the biceps muscle, above the flexure of the elbow, the median nerve and the musculospiral nerve were exposed and injected with 80 per cent alcohol. Their lack of conductivity was demonstrated with the battery. Through a longitudinal incision over the internal condyle the ulna nerve was drawn up to the wound, also injected with 80 per cent alcohol. Wounds closed with subcutaneous catgut suture. Good recovery.

October 29, 1909. Patient discharged from hospital Wounds healed.

No definite conclusion can be given concerning this case, as it is at the present time under observation. It may be said, however, that the tic movements have totally disappeared as would be naturally expected, on account of paralysis of the distally involved muscles. The other muscles which took part in the tic movement and which were unaffected by the operation do not show any evidence of abnormal or uncontrolled movements. The case is further of interest in regard to the whole question of paralyses produced by alcoholic injections of the nerve from the point of view of trophic disturbance and the length of time of regeneration. Concerning the trophic functions of the nerves involved there has been an interesting and unexpected feature in this case, although as can be seen from diagrams there is a total lack of sensation in the region supplied by the three nerves injected. The patient showed no positive signs of trophic disturbance. About three months after the operation the patient received a severe burn on the back of his fingers. This healed as quickly as would a similar burn on a normal hand. The return of sensation is extremely slow in this case. It is now six months after the operation and the demarcation between normal sensory areas of the skin and those affected by the operation show only very slight variation from the first examination. Although this might seem slow, yet its constant though small increase shows that there is a marked and positive tendency towards sensory regeneration. Up to the present time there is no evidence of motor regeneration whatever. On the other hand there is very little tendency towards atrophy of the muscles supplied by the injected nerves.

Extension at wrist has returned.

GROUP IV

One case. A detailed report of this case will be made in a subsequent paper.

THE TREATMENT OF SPASTICITY AND ATHETOSIS BY RESECTION OF THE POSTERIOR ROOTS OF THE SPINAL CORD[1]

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THERE is no functional disturbance of the extremities, which has so baffled attempts at relief, surgical or otherwise, as spasticity of the muscles whether of spinal or cerebral origin. Correction of deformities and faulty position of the limbs by tenotomies, the use of restraining apparatus, educational exercises, and passive motion, the conventional procedures, are merely palliative measures; they do not attempt to reach the root of the trouble, but only endeavor to treat as it were the end results.

The first suggestion to deal with spasticity and kindred conditions, such as athetosis, in a radical way, with proper consideration of their physiological and pathological perversions, came from Spiller in 1905, when in a paper before the New York Neurological Society (Journal of Nervous and Mental Diseases, May, 1905), he advocated resection of the posterior roots for the relief of spasticity in the following words: "Where athetosis exists the muscles are in a state of greatly increased tonicity and often are abnormally well developed and abnormally strong. Theoretically, the proper procedure might be to cut the posterior roots of the affected limbs, the number to be cut depending on the condition in each case; but this is always a serious operation and the results have at times been unexpectedly grave."

Between the date of Spiller's suggestion in 1905 and the date of the first operation in 1909, there have appeared two articles by Dr. O. Förster of Breslau, one in 1908 (Zeitschrift für Orthopädische Chirurgie, bd. xxii, 1908) and one in 1909 (Mittheilungen aus d. Grenzgeb. d. Med. und Chir., bd. xx, No. 3, p. 493). These articles contain a very exhaustive consideration of the whole subject from its theoretical as well as its practical aspect and include the report of a series of five cases, operated upon by Prof. Tietze in the Allerheiligen Hospital at Breslau. In the same journal there is an article by Prof. Tietze dealing only with the surgical aspects of the question. Somewhat later we find an article by Gottstein reporting two cases; in the January, 1910, issue of the University of Pennsylvania Medical Bulletin appeared an article by Spiller and the author, with the report of one case, and in the New York Medical Journal, January 29, 1910, the last article of the series was published by Clark and Taylor. So far as I can ascertain from a careful perusal of the index files of the past two years these four articles comprise the entire available literature upon this very interesting topic.

It is my intention to present to you in an impartial way the results thus far obtained, with such commentary as I feel justified in making from my own limited experience. The matter must still be considered in embryo, however, and at this time any report must be regarded only in the light of a preliminary contribution.

Before analyzing the records of the operative cases, it would not be amiss at this juncture to present the theoretical considerations upon which this therapeutic consideration is founded.

The presence of an organic lesion in the motor tracts, causing an interruption in the transmission of impulses from brain to cord and from cord to peripheral nerves inevitably gives rise to a functional disturbance, varying in its distribution according to the situation of the lesion, characterized chiefly by paresis and muscular contractures. When the motor impulse from brain to muscle is partially or entirely interrupted, voluntary movements are either partially or entirely abolished. The muscles thus liberated from the controlling influence of the cortex pass into a state of involuntary excitation or tension; the joints become fixed in an abnormal position and a definite resistance is offered to voluntary muscular action because of the pathological state known as spasticity.

Spasticity is believed by some to be a reflex process, originating in sensory peripheral

[1] Read by invitation before a joint meeting of the Chicago Surgical Society and the Chicago Neurological Society, May 13, 1910.

impulses from the skin, joints, ligaments, and especially the muscles. These impulses are transmitted by the sensory nerves and the posterior roots to the cord, thence via the anterior horns, roots, and motor nerves to the muscles.

This reflex process is present under normal conditions and is directly involved in the intimate co-ordination between the extensor and flexor group in all joint movements, giving rise to a certain amount of fixation in the delicately balanced resistance of diametrically opposed groups of muscles. Under normal conditions this fixation and this resistance is present only to a moderate degree because of the restraining influence of the cortex acting through the pyramidal tracts. When, however, this inhibitory action is interrupted by a lesion of the motor tract, there follows the inordinate and excessive joint fixation and muscular resistance so conspicuous in all spastic conditions.

We must not lose sight at this juncture of the essential premise that the fixation of the joint and the resistance to movements in the normal subject is a reflex process; examples of this, as Förster says, may be seen in the effects of certain cord lesions; thus in tabes dorsalis where the sensory apparatus of the cord is affected and the reflex arc broken, there is, as is well known, a diminution of the reflexes, and as a result the joint fixation is below standard, the resistance to movement lessened; in other words, the muscles offer no resistance to each other and their reciprocal relation is lost. Or again take for example a case in which the primal lesion is in the lateral columns of the cord and there develops the usual severe muscular contractures; if subsequently, there develops a lesion of the posterior or sensory columns the pre-existing contractures will disappear. This implies of course that the lesion in the posterior columns corresponds to that segment of the cord included in the reflex arc of the affected muscles. Or, finally, if following a pre-existing lesion of the posterior columns, as in tabes dorsalis, there develops a lesion of the pyramidal tracts, whether in the lateral columns of the thoracic cord or in the internal capsule, while there will be more or less paresis, there will be no muscular contractures.

If we admit that spasticity or spastic muscular contractures are reflex disturbances, unrestrained by cortical impulses, one way, if not the only way of controlling them, is to remove at least one link in the chain of the reflex arc. Naturally the motor portion of the arc, the anterior horns, the roots, or the peripheral nerves cannot be broken, otherwise the limb would be hopelessly paralyzed; for the same reason the sensory nerves, many of which are mixed nerves, must be left intact, so that by a process of exclusion there remain the sensory roots.

In these explanatory remarks many facts have been presented, which are so elementary that to such a learned audience as this they would appear superfluous. However, in the face of such criticism I venture to present them, elementary as they may be, since they represent the foundation stones upon which the rationale of the operation has been constructed.

My personal experience with the operation has been limited to three cases; these cases have, however, been most instructive as representing two distinct types of spasticity, two of spinal origin involving the lower extremities alone and the other of cerebral origin involving both upper and lower extremities and associated with very exaggerated athetoid movements.

CASE 1. *Spastic paraplegia.* (Note: The following is an abstract of the case which has been reported in full by Spiller and the author in the University of Pennsylvania Medical Bulletin, January, 1910.) A. K., age 43 years, unmarried, was admitted to my service at the Philadelphia General Hospital, January 6, 1907, and at the time of operation was in the service of Dr. Charles S. Potts, to whom we are indebted for the case.

On Christmas, 1903, he became intoxicated and went to sleep on the floor in a cold room. He awoke feeling cold and chilly and uncertain on his legs. For two months after this he felt weak in his legs when walking a beam or in a perilous position — his occupation being structural iron worker. On April 17, 1904, he fell backwards in a dark room, a distance of one step. In falling his head struck against the wall. From the effects of this blow he became momentarily unconscious, but soon regained consciousness and tried to rise. He was completely powerless to move the lower limbs in the slightest degree. All parts below the costal margins felt as though "ants were crawling all over." He was carried to bed and slept four hours. On awakening his condition remained as described above, the lower limbs being completely paralyzed. He attempted to pull himself out of bed, when a sharp pain was felt in the

lumbar region. For ten days after the accident he retained control over his bowels and bladder, and then for eight or nine months he had to be catheterized regularly and given rectal injection to empty the bowels.

After nine months of catherization he had recovered control of urination, although sometimes as much as five minutes were required in which to start the stream.

After nine months of rectal injections he could defecate, provided purgatives were taken regularly. He continued to take purgatives until his bowels were emptied normally.

From the time of the accident he was in bed nine months. He used a rolling chair about one year.

From that time on he could bear his weight on his lower limbs and moved about with the aid of a cane and one crutch, but would lose his balance trying to walk with two crutches. He states that during the first nine months following the injury he had no sensation of any kind in the lower limbs and trunk to a line about two inches above the umbilicus. Since that time sensation has returned, and he has sensation in all parts of the lower limbs.

Just before the operation voluntary power in lower limbs was thought to be about normal, but spasticity in these limbs was extreme. The patient could not separate the thighs because of this great spasticity. The patellar tendon reflexes were exaggerated and patellar clonus, persistent ankle clonus, and Babinski reflex were present on both sides. The cremasteric reflex was prompt on each side. He had control both over the bladder and rectum. He was able to walk only with the aid of a crutch and cane because of the extreme spasticity; the toes of one foot caught behind the heel of the other foot in walking, and when he was standing still the heels did not touch the ground.

Operation, September 27, 1909. The operation was performed under spinal anæsthesia because of an existing bronchitis. A curved incision was made from just above the first to just below the fifth lumbar vertebra through the skin down to the aponeurosis. The cutaneous flap, with its convexity toward the right, was reflected and a vertical incision in the aponeurosis made along the tips of the spinous processes. The muscles were separated on either side from those and the laminæ; the spinous processes were removed with bone forceps and the laminæ with the rongeur. The dura was incised and the first sacral nerve identified by its point of exit through the dura (on a level with the spinous process of the fifth lumbar vertebra). With this nerve identified, the sensory roots of the fifth, third, and second lumbar nerves on either side were easily found and resected. The dural wound was closed with a continuous catgut suture, and in turn the muscular, aponeurotic, and cutaneous wounds. At the conclusion of the operation his condition was perfectly satisfactory.

When examined by Spiller only one day after the operation, the patellar and cremasteric reflexes were completely lost, the Achilles reflex was nearly normal on one side and weak on the other; the legs, as the patient lay in bed, were in a position of abduction showing already that the spastic condition of the adductors had been abolished. The patient complained bitterly of pain in the back and limbs, which was aggravated by either pressure or active motion.

Three months after the operation the patient could separate the thighs, flex and extend them almost to a normal degree; the movements of the ankle joint were quite free, he could place his foot firmly on the ground, he could walk up stairs with comparative ease. He still had to use his cane and crutch, the patellar and Achilles reflexes were present but not normal.

The last examination was made April 20, 1910, with the following results:

Reflexes. Patellar reflexes very slight on each side, response scarcely perceptible; slight ankle clonus on both sides; plantar reflex exaggerated on each side.

Passive movements. On both sides there is slight resistance offered in fully extending leg on thigh. Movements of the ankle joint and of hip joint almost normal.

Voluntary movements. Sitting down the patient can fully extend leg on thigh; he can flex the foot (dorsal flexion) on both sides enough to raise toes off the floor; he can flex thigh on abdomen to right angle. On both sides there is practically no voluntary movement in the direction of abduction on either side; patient is able, however, to stand with legs widely separated; to go up and down stairs without any support, to walk a short distance without a cane, and in standing between two chairs is able to let himself down in a squatting posture and stand up again. These are all movements which were quite impossible before the operation. He complains quite a great deal of pan in flexion and extension of the back, referred to the spine just below the level of the spinous process of the fifth lumbar vertebra. There is no difficulty either in micturition or defecation; the root pains of which he complained before the operation and still more bitterly immediately afterwards have entirey disappeared.

I have excluded any reference to disturbance of sensation purposely. These will be found in the first report, and while they are interesting to those who want to study the areas of distribution of the spinal nerves they have no direct bearing upon the results of the operation as they affect the functional disturbances resulting from spasticity.

Summary. A case of spastic paraplegia in a male aged 43; resection of the second, third, and fifth pair of sensory roots of the lumbar cord. Conspicuous features before the operation were the inability to place heels on the ground, the difficulty in getting toes of one foot from behind the heel of the other while walking, the inability to separate thighs or to raise foot from floor, extreme exertion required to take a single step, and the more or less constant pain. After the operation practically every evidence of spasticity had disappeared; the patient walked with greater ease, voluntarily flexed

thigh on abdomen, leg on thigh, foot on leg. He could voluntarily adduct thighs, plant whole surface of foot directly on the floor, and could stand and walk a short distance without support. The reflexes, at first abolished, were later partially restored; later partial restoration of the reflexes.

That resection of the posterior roots of the spinal cord will relieve spasticity at least of spinal origin, and in the lower extremities, has been demonstrated in this case beyond a question of doubt. One could scarcely hope for a more substantial proof even if judged by the exacting standards of laboratory experimentation. The spasticity has been practically abolished and voluntary motion of individual joints has been restored. It must not be assumed, however, that because of these accomplishments the difficulties of locomotion are altogether abolished; the freedom with which the patient will be able to walk after spasticity has been abolished will depend very largely upon how much muscular weakness is associated with the spasticity. In the case under consideration there was a great deal more muscular weakness before the operation than we anticipated. So that while the patient's condition is manifestly and tremendously improved there is still some physical impairment. That this may be benefited to a not inconsiderable degree by systematic instruction in graduated exercise could only be expected, so that the end results in a given case will not be realized until a course of physical education has been enforced.

CASE 2. *Infantile spastic diplegia.* F. J. H., File No. 1105. (The history of this case will be found in an article by Spiller, Frazier and Van Kaathoven, published in the American Journal of Medical Sciences, March, 1906.)

To those who may not have an opportunity to consult the original article it may be said here that an attempt was made to overcome the athetosis by an operation upon the peripheral nerves of the following character: The central segment of the nerves supplying the flexor muscles were anastomosed with the peripheral nerves supplying the extensor muscles. In this way there was a complete transference of the flexor innervation into the extensor group and vice versa.

He was readmitted to the University Hospital in my service, January 5, 1910. At this time the condition of the lower extremities differed in no way from that noticed when he was under observation five years ago. The motor disturbances of the upper extremities, which exhibited some transitory improvement following the elaborate cross anastomosis of the peripheral nerves of the brachial plexus, were quite as exaggerated now as they had been at any time. All the characteristic features of an infantile spastic diplegia were present, including the spasticity and muscular contractures, not of the stabile type, but those in which, accompanying voluntary movements there is a spastic innervation of the muscles, so that every effort at movement caused muscular spasms which interfered with any simple movement. Voluntary or associated movements (die mitbewegungen) were most pronounced and involved not only the upper extremities but the neck, back, and lower extremities.

The excessive spasticity especially of the flexor and adductor groups, rendered any voluntary movements a matter of the greatest difficulty. The forearm was usually forcibly flexed on the arm and frequently the upper extremity viciously held in the grasp of the adductors behind the trunk, a position which the patient was powerless to change. The action of the spastic muscles could be overcome only by using great force. The patient was absolutely hopelessly a cripple; he could not feed himself, he was dressed and undressed with only the greatest difficulty, and the violent muscular movements wrought havoc on his clothes. A more appealing case could not have been found; nor one better suited to test the effectiveness of the operation under consideration.

First stage. Operation, January 8, 1910. Laminectomy; resection seventh and eighth posterior cervical roots. Under ether anæsthesia with the patient on his face, head flexed and resting on the lap of etherizer, a curved incision was made from just above the fourth cervical to just below the first thoracic vertebra. Guide sutures were introduced in the skin on either side opposite the intervertebral discs (*a*) between the seventh cervical and first dorsal, and (*b*) between the fifth and sixth cervical vertebræ. The roots were to be identified by their point of emergence from the dural sac as follows:

The seventh cervical root leaves the dural sac between the sixth and seventh cervical vertebræ; the eighth cervical root leaves the dural sac between the seventh cervical and first thoracic vertebra.

By removing the laminæ of the seventh cervical and only a portion of the sixth, the second and eighth roots were exposed and resected. So much time had already elapsed because of the free bleeding and the difficulty in gaining access to the canal at that level that it was decided to postpone until a future date resection of the fifth and sixth roots as originally contemplated.

In dividing the roots, it was not possible even with the aid of a powerful magnifying glass to recognize and isolate the arteries accompanying the roots. Hæmorrhage was readily controlled by hot tampons, the dural wound was closed with continuous catgut sutures, the aponeurosis with continuous chromic catgut sutures, and the skin with silk. Owing to hem-

orrhage from one of the vertebral veins it was necessary to leave in the wound a gauze tampon.

A rather interesting observation was made in the diffusion of solutions used for spinal anæsthesia. Just before the dural sac was opened in the cervical region 1 cc. of sterile water stained with indigo carmine was injected between the first and second lumbar vertebræ, the point of selection for injections in spinal anæsthesia. The dural sac in the cervical region was immediately opened, but there was no sign of the colored fluid coming from the canal nor at any time during the operation, despite the fact that cerebrospinal fluid was flowing quite freely from the wound.

Résumé second stage. Operation, February 17, 1910. The second stage of the operation was not performed until six weeks later. Realizing the difficulties and the awkwardness experienced at the first operation it was decided to adopt a different method of procedure. As the third and fourth cervical vertebræ are not far distant from that portion of the skull immediately overlying the cerebellar hemispheres, it was decided to adopt the same method as for exposure of these structures. Accordingly, with the patient on his side, head of the bed table elevated, and head flexed, a crossbow incision was made down to the aponeurosis, with the horizontal limb on a level with the tip of the mastoid process. The aponeurosis was divided in the median line, the muscles separated until the spinous processes of the second, third, and fourth cervical vertebræ were exposed; the two latter, and the right half of the laminæ of the fourth and fifth cervical vertebræ were removed. The dural sac was opened and the fifth and sixth roots divided on either side. There was some discussion at the time as to whether the fifth and sixth or the sixth and an uncut portion of the seventh was removed, because what was taken for the fifth came off the cord at the level of the spinous process of the third cervical vertebra which is a little low for the fifth and a little high for the sixth. As there was no doubt that two whole roots were divided at the first operation, the sixth and eighth, it was natural to assume that the two roots divided at the second operation were the fifth and sixth. An attempt was made again to isolate the artery from the root, but to no avail. The wounds were closed with tier sutures, as at the first operation.

Following both operations the patient suffered not inconsiderably from root pains, and especially after the second operation there was free perspiration about the face, head, and neck continuing for several weeks. As was observed in case 1, any attempt at passive motion occasioned considerable pain. Some improvement was noted after the first of the two operations, that is, there was less spasticity and some voluntary motion at either wrist. The last examination was made April 20, 1910, about two months after the second operation, with the following results:

Passive movements. Right upper extremity: While the spasticity is less than it was before, there is still enough to make it difficult to extend the forearm on the arm, the wrist however, is easily extended on the forearm; the fingers are in a state of extreme flexion, due probably to the shortening of the flexor tendons. Left upper extremity: Here the spasticity is not nearly so marked; the forarm can be brought to right angle with ease and without much difficulty extended on the arm; the movements at the wrist in this as in the other arm are free and unimpeded; the fingers are in complete flexion owing to the shortening of the flexor tendons.

Voluntary movements. Right upper extremity: Patient can put his hand to his mouth, to his forehead, and ear without much difficulty; he can flex the forearm on arm, and can flex and extend the hand on the forearm (dorsal and plantar flexion). Left upper extremity: Patient can put hand to mouth, nose, forehead and ear; he cannot, however, extend the forearm beyond a right angle. The movements at the wrist joint are, if anything, freer and more easily accomplished than on the right side. Individual voluntary movements of any of the joints is practically impossible; any attempt at voluntary flexion or extension of an individual joint in either extremity is associated with movements of other joints, not only of the same extremity but in the extremity of the opposite side. Not only are the associated movements marked in both upper extremities but almost equally so in the neck, back, and lower extremities.

The root pains so severe immediately after the operation and persisting for almost seven weeks have practically disappeared.

In comparing his condition now, some eight weeks after the operation, with that which existed prior to the operation, the patient regards his condition as improved in that he has more control over the movements of his arms. Whereas, before the operation, the right arm especially was forced involuntarily behind the back, he is now able to keep it in front, and with both arms he can make voluntary movements which prior to the operation were impossible.

The athetoid movements, so conspicuous before the operation, have practically disappeared, except in certain concentrated effort to make certain movements. In this respect there is a very striking change for the better.

The after treatment has consisted in passive motion, in massage, and in the practice of graduated exercises.

Summary. Spastic congenital diplegia, in a patient aged 24 years. Resection of fifth, sixth, seventh, and eighth pairs of sensory roots of cervical cord. Eight weeks after operation almost complete disappearance of athetoid movements; spasticity considerably diminished but by no means abolished; voluntary movements and control of both extremities, especially at wrist joint, possible to a

much greater degree; individual voluntary movements not restored, associated movements pronounced. While the condition of the upper extremities has improved there has been some improvement also in the condition of the lower extremities; the patient is able to walk with less difficulty and falls less frequently. The present condition is not stationary; improvement continues daily; final opinion as to end results must be reserved.

As compared with the first case the results in the second are disappointing, especially in that the spasticity and the associated movements have not been entirely abolished. That he has been benefited by the operation is not open to question, and while the patient is himself satisfied with what has been accomplished, the results are so far from brilliant that we are at once tempted to dive into speculation as to the cause of the difference in the results between the first and second case; is it because one is of spinal, the other of cerebral origin, is it because one involves the upper, the other the lower extremities, or is it that a mistake was made in the selection or in the number of the roots to be resected. These are interesting problems and will be taken up later on.

CASE 3. *Spastic paraplegia.* J. M. aged 19 years, was referred to my service at the University Hospital, April 22, 1910, by Dr. William G. Spiller. There was no history of previous injury, but the lower limbs were always weak. The patient was unable to walk until he was four years of age and from that time on had gradual increasing difficulty in using his legs so that when ten years old he began to use crutches, and has used them ever since. Gradually his legs became flexed on his thighs to a right angle. His general health is good and his mentality normal. In the family history we found a maternal uncle similarly affected.

Examination. The upper extremities are normal. There is distinct wasting of the lower portion of the thighs and legs. The thighs are flexed on pelvis and the legs flexed on thighs. It is impossible to extend the legs beyond a right angle, owing to the muscular resistance, and there is considerable difficulty in extending the legs even to this degree. There are frequent involuntary movements of the legs. The feet are in a position of extreme dorsal flexion which cannot be overcome. The patellar and Achilles reflexes are exaggerated. The Babinski reflex is present on both sides but there is no ankle clonus. The patient is able to stand unsupported with knees and hips at an angle of 20 degrees, and can even take very short steps unsupported by twisting his body from side to side.

Operation. May 7, 1910. Laminectomy. Operative notes. The incision extended from the spinous process of the second lumbar vertebra to one inch below the spinous process of the fifth lumbar vertebra. The spinous processes of the second, third, fourth, and fifth lumbar vertebræ were removed, as well as the corresponding laminæ. The dura was opened, and the first sacral nerve identified by its point of emergence from the dural sac opposite the spinous process of the fifth lumbar vertebra. This was divided on either side. The fifth lumbar pair was then divided. It was decided to leave the fourth pair intact. The third pair were found a little above the level of the upper margin of the spinous process of the second lumbar vertebra. This pair was exposed and cut with difficulty, even though the laminæ and spinous process of the second lumbar had been removed.

According to our observations the second lumbar roots must have left the dural sac above the second lumbar vertebra, and probably an inch above, because they could not be seen. The posterior roots of the fifth lumbar were two, if not three times as large as what was taken to be the fourth, and the question arose in our minds as to whether what we took to be only the fifth might not have been the fourth and fifth leaving the canal by the same opening. If this assumption is correct, the uppermost root we cut, may have been the second, and the root left intact, the third.

Four days after the operation it was noted that the patient had comparatively little root pain. The legs could be extended on the thighs beyond a right angle up to the point at which motion is arrested by the contracted tendons. The thighs could be extended on the pelvis almost completely and the dorsal flexion of the feet partially corrected. There was some slight voluntary motion in the thighs and legs. Knee jerks, ankle clonus and Achilles were present and the Babinski is present on both sides. There is apparently no impairment of sensation. Any attempt at passive motion causes muscular spasm.

When examined May 23, 1910, one month after the operation the following was noted: Left lower limb can be almost fully extended at the knee but there is resistance at this point on account of the shortening of the tendons which prevents full extension of the leg on the thigh. The right leg can be extended considerably on the thigh but not so much as the left. There is no apparent spasticity of the lower limbs, but much shortening of the hamstring tendons. Voluntary power in the lower limbs is almost equal to that existing before the cutting of the roots. Touch and pain sensation are normal in all parts of the lower limbs, even over the anterior parts of the thighs. The patellar reflex is entirely lost on the left side, about normal on the right side. Achilles reflex absent on both sides.

TECHNIQUE

Suggested by the difficulties in my own experience as well as that of others, there are certain matters of technique which are worthy of passing comment. The division of the

operation into two stages, a practice to which European surgeons cling both in cranial and spinal work, almost as a routine procedure, I cannot endorse. In practically all the operations reported by Tietze, Gottstein, and Küttner, this method was resorted to. It may have some advantages but these are more than outweighed by the disadvantages. The additional risks of a second anæsthetization in subjects by no means good operative risks, the superadded danger of infection in operating through a wound that has been opened and exposed to infection for several days, are very serious objections to the two stage method. That there will be less bleeding at the second sitting of a two stage operation and therefore a more satisfactory exposure of the structures of the cord, goes without saying, but hæmorrhage is readily controlled by posture and by the intelligent use of gauze tampons. There are practically but two sources of hæmorrhage; one from the exposed muscle surface, the other from the posterior plexus of veins overlying the cord. A large tampon over the muscle surface on either side, and a small tampon to the outer side of the dural flap on either side will control the major portion of the bleeding. Should there be any leakage of blood into the dural sac, enough to obscure the view, the field should be cleared by continuous irrigation of hot saline solution, rather than by sponging, in order to avoid unnecessary trauma to the cord or roots. Before the wound is closed it is especially important that every vestige of blood be removed.

It is scarcely necessary to caution against needless trauma of the cord, and yet we find that in one of Tietze's cases the damage done to the cauda equina at the operation caused the death of the patient. So great was the injury to the cauda equina that the operation was followed by total paralysis and loss of sensation in the lower extremities, cystitis, and decubitus. A severe erysipelatous infection developed from the decubitus from which the patient died two months after the operation.

Especially in operations upon the lumbar region should every precaution be taken to disinfect thoroughly the skin in a region which in these more or less helpless patients is none too clean, and quite as carefully to guard against contamination of the wound after the operation.

The prompt repair of the wound depends not only upon the avoidance of infection and control of hæmorrhage, but to some extent upon the promptness with which the flow of cerebrospinal fluid is arrested. To this end it is of advantage not to have any direct communication between the surface and the dural sac. For this reason I make a curved incision in the skin with convexity to either side, a vertical incision in the aponeurosis a little to one side of the median line, and separate the muscles in the median directly over the spinous processes. Thus in these three tiers the incision of one does not directly correspond in position to that of the other, so that from the surface to the depths of the wound there is no direct channel along which the cerebrospinal fluid may escape and establish a sinus. The skin, aponeurosis, and the dura are closed with continuous sutures, the muscles with interrupted, and a small cigarette drain to be removed in 24 hours, introduced through a stab wound in the cutaneous flap, at the lower angle of the wound down to the dura. To further guard against infection the wound should be painted with Whitehead's varnish, the dressing entirely protected by adhesive plaster and urotropin administered by mouth until the wound is closed.

Should any modification in the technique for laminectomy performed for other purposes be considered? To be able to identify each posterior root with any degree of positiveness, to separate it from the anterior root requires an ample exposure and a dry field. To accomplish this it may not be necessary to remove three or four or five successive laminæ according to the number of roots to be divided. For example, in one of my cases (case 2) to divide the seventh and eighth cervical roots I removed only the lamina of one vertebra entirely and only a portion of another. In this way the continuity of the arch of one lamina was not broken and its function largely preserved. To divide the fifth and sixth cervical roots in the same case, after removing the spinous processes, *I resected only half of the laminæ* of two vertebræ. Theoretically, at least, partial resection is to be preferred to com-

plete resection of the laminæ, and for this reason some attempt should be made to preserve a portion of one or more laminæ as in the case above mentioned.

Taylor recommends a unilateral laminectomy in all cases and by this method obtains an approach of 1.3 cm. in the cervical, 1 cm. in the dorsal, and 1.5 cm. in the lumbar region. But in all of Taylor's cases, save one, in every one of his three cervical cases, he was called upon to resect the roots upon one side only. For such a unilateral opening may be ample, but when one comes to expose the roots upon the opposite side through a unilateral opening, the task while feasible is not easy, requires a little more patience, and endangers the cord more to trauma, as it will be necessary to retract the cord somewhat toward the side of opening to adequately expose the roots on the opposite side. In this connection it should be borne in mind that it is very much easier to expose the cord in children than in adults, and much easier to expose the cord in the cervical than in the lumbar region. I notice in a case reported by Dr. J. J. Morehead (Medical Record, May 14, 1910) that at the operation which was performed by Dr. Taylor, the latter found it impossible to expose a sufficient amount of the cord in the lumbar region by a hæmilaminectomy. This, I believe, will be the experience of a majority of operators who attempt the hæmilaminectomy in the lumbar region.

In a muscular adult the canal in the lumbar region lies far below the surface; at this level we have to deal with the cauda equina, and it is very much more difficult here to identify one root from another and still more difficult to differentiate the posterior from the anterior roots. In the cervical region the roots leave the dorsal sac not far from their exit from the cord so that it is quite easy to trace the root to its point of origin, and see whether it comes off from the anterior or posterior aspect of the cord.

It would be quite misleading, therefore, to leave one with the impression that the identification of the roots is an easy and simple procedure even with a comparatively large exposure. The smaller the opening in the canal the more will one feel hampered. In two of Förster's cases Tietze mistook the first sacral for the second sacral root and the fourth lumbar for the fifth lumbar. One must bear in mind also the possibility of anomalies as in Gottstein's second case, where the fifth lumbar and first sacral made their exit from the dural sac through the same orifice.

Whether or not it is possible to isolate and preserve intact the artery accompanying the root is a matter to which Spiller attaches considerable importance. In certain instances, division of the sensory roots for the relief of pain, as in the tabetic crises, has been followed by degenerative changes in the cord, and these in turn have been attributed to the destruction of the arteries accompanying the roots. On two occasions I attempted by the use of a strong magnifying glass to find and isolate these arteries, but on both occasions, even with the additional aid of strong artificial light, the attempt failed.

Without doubt the most important technical consideration is the selection of the roots to be sacrificed. In the cases thus far reported, the operator has been governed by such knowledge as we have regarding the distribution of the spinal roots. Thus, for example, it is known that the supply of each muscle or group of muscles is represented in most instances by three segments of the cord and by as many roots and, according to the observations of Sherrington, the cutaneous nerve supply of any given area is derived from at least three roots. Theoretically we plan to break the reflex arc of the muscles involved, by cutting off as many peripheral stimuli as possible; we should not, however, remove every source of sensory stimulation, otherwise we would substitute a condition of absolute anæsthesia and flaccidity for one of spasticity. In selecting the roots to be sacrificed it is necessary obviously to remove at least two of the three possible sources of sensory stimulation, or in other words, two of the three roots from which a given group of muscles derives its sensory supply. The following table gives the sensory distribution to the muscles of the lower extremities:

Flexors of the thigh $L_1L_2L_3L_4L_5S_1$
Extensors of the thigh $L_5S_1S_2$
Adductors of the thigh $L_2L_3L_4(L_5)$
Abductors of the thigh $L_5S_1S_2$

Exter. rotators of the thigh $L_5S_1S_2$
Int. rotators of the thigh $L_3L_4L_5S_1S_2$
Extensors of the leg $L_2L_3L_4$
Flexors of the leg $L_3S_1S_2$
Dorsal flexors foot $L_4L_5S_1$
Plantar flexors foot $L_5S_1S_2$

In considering an operation for spastic paraplegia there are seven roots to be considered, namely, the five lumbar and the first two sacral roots. According to Förster's first dictum at least four roots should be sacrificed and he selected for the lower extremity, the second, third, and fifth lumbar and the second sacral, leaving intact the first, the fourth lumbar, and the first sacral. The general rule has been not to remove more than two successive roots.

If the results of some of the operations have been accurately recorded our views regarding the sensory distribution of the spinal roots may have to be revised. Thus Taylor in one case resected six successive roots, from the twelfth dorsal to the fifth lumbar inclusive, on one side with full retention of sensation, and in another case seven successive roots from the fourth cervical to the second dorsal inclusive, without loss of reflexes. This is absolutely at variance with our present conception of the distribution of the spinal roots and suggests the possibility of the operator having left some fibers undivided. The difficulty in separating the sensory from the motor roots may be attributed to the inadequate exposure of a unilateral opening.

Whether or not it may be possible to resect a series of five, six, or seven successive roots without permanent disturbance of sensation or reflexes in a given extremity, it is unquestionably true that the desired end may be attained, the spasticity relieved, by resecting four out of seven of the total number of roots supplying a given area. Thus in one of Förster's cases, one of Gottstein's, and two of my own the spasticity was relieved by resection of three lumbar, or three lumbar and one sacral root.

On the other hand if too few roots are resected the results may not be as satisfactory. This was the case in one of Förster's patients where he resected only the third and fifth lumbar and the second sacral, and in one of my own, where although four successive roots were resected, namely the fifth, sixth, seventh and eighth cervical, the spasticity was only partially relieved. Therefore, at this juncture it is not possible to lay down any hard and fast rule, suffice it to say that for the lower extremity perfectly satisfactory results have been obtained after resection of the following combinations:

1. $L_2L_3L_5$
2. $L_2L_3L_5S_2$ or
3. $L_2L_3L_5S_1$.

For the upper extremity the following combination $C_4C_5C_6C_7$ was wholly effective in one case (Taylor's third case) while $C_5C_6C_7C_8$ only partially so in another (Frazier's second case). We may conclude from this that until further observations are made the fourth cervical should be included, with or without the eighth.

After treatment. To attain the best results or rather the maximum benefit after root division a course of systematic exercises must be inaugurated under the direction of a thoroughly competent person. My first patient I placed under the care of Dr. Burdick who is thoroughly conversant with the application of exercise to the correction of deformities, disturbances of station, gait, etc. It was quite evident from the beginning that the patient had to be re-educated, that he had to receive as it were a graded course in which the first exercises were of the most elementary type. The patient had forgotten entirely, because of previous incapacity, how to use certain groups of muscles, how to make certain isolated movements of the limb. The muscles had from disuse become more or less atrophied.

In addition to a course in physical training it may be necessary to correct these deformities which have resulted from prolonged muscular contraction and spasticity. Section of the roots has of course no influence upon the ligamentous and tendinous contractures. To correct these deformities it may be a tenotomy, myotomy, or tendon transplantation may be necessary. The discouraging results derived from these methods alone are too well known; in striking contrast, however, are the results of tenotomies after root resection. Where the spasticity has been altogether or largely abolished, the deformity, once corrected, will not recur.

Immediate results. Of the fifteen operations now on record two terminated fatally; one case (Förster and Tietze) died of infection, the

other of shock. Both cases were adults. The first should not be counted against the operation, as from the published report, it is candidly admitted that so much damage was inflicted upon the cord that complete paralysis, anæsthesia, cystitis, and decubitis followed. It must be assumed that the mortality will depend very largely upon the condition of the patient and that this must be given due consideration in advising for or against operation in any given case.

The beneficial effects of the operation must not be looked for at once. There will be a period varying from several days to several weeks in which the patient will suffer more or less acutely from shooting pains. These pains are from impulses transmitted through the central portion of the cut roots and to a less degree from the handling of the roots that are not cut. After the degeneration of the cut posterior roots is complete the pains will disappear (Spiller). Immediately afterwards the reflexes may be entirely abolished as in some of the cases recorded later to be partially or completely restored. So, too, some ataxia may be observed, but this is not so conspicuous and frequently not permanent.

Neither must restoration of voluntary movements be looked for too soon. Right after the operation there is some aggravation of the patient's condition. The muscles and tendons after the roots are cut and until they are completely degenerated, are extremely tender. Every attempt at motion, the mere stretching of the contracted muscle, elicits so much pain that the patient is disinclined to make any voluntary movement and attempts at passive movement are resisted for the same reason. Therefore while the spasticity may be and often is entirely relieved by the operation the movements of the limb will for a time be quite restricted.

Results. To give you a clear and comprehensive conception of just how much has been accomplished I have taken the records of all published cases. Kotzenberg, Küttner, and Tietze (Berliner Klin. Wochenschrift, 1909, p. 709) have operated respectively upon two, five, and two cases, but as these have not been published, there remain for analysis thirteen cases, two operated upon by Gottstein, three by Clark, four by Tietze, one by Wood, and three by myself. The following is a résumé of the series:

CASE 1 (Spiller and Frazier, see page 252). In a man, aged 43 years, with spastic paraplegia, the L_2L_3 and L_5 roots were resected. Sensation was only partially disturbed, the extreme spasticity was practically abolished. Voluntary movements were restored to a remarkable degree and limited only by loss of muscular power. Patient's gait decidedly improved; can stand and walk a few steps alone, and go up stairs without aid of crutches.

CASE 2 (Spiller and Frazier, see page 254). A young man with cerebral spastic diplegia, the spasticity was of the most extreme type, as were the involuntary movements; the patient was absolutely helpless. The $C_5C_6C_7$ and C_8 roots were cut on both sides with positive but only partial relief. The athetotic movements were practically eliminated but the associated movements were not relieved. Voluntary motion was partially restored, especially in wrist joints and fingers, but other movements were much hampered by a considerable amount of residual spasticity.

CASE 3 (Spiller and Frazier, see page 256). A young man seventeen years of age with spastic paraplegia and marked secondary contractures of the lower limbs. Patient has been using crutches for the last ten years and is practically helpless. The first sacral and the fifth and third lumbar roots were cut on both sides. The spasticity has been relieved but the marked joint contractures interfere with any satisfactory examination as to range of motion in the various joints.

CASE 4 (Wood). An adult with traumatic spastic paraplegia following a fall from a trolley car eight months ago. Dr. Wood divided the second, third, and fifth lumbar roots at one sitting, and at another sitting the first sacral. Nineteen days after the operation sensation was impaired in the distribution of the second and third lumbar roots, the knee jerks were entirely gone, the thighs can be gradually separated for about a foot, and the legs extended on the thighs to an obtuse angle. Whether the resistance to passive motion is due to any residual spasticity or to the muscle irritability cannot be determined at this time.

CASE 5 (Gottstein). For the relief of high grade spasticity in hip, knee, and ankle on both sides in a male aged 24 years, Gottstein resected the $L_2L_3L_5S_2$ roots. The spasticity disappeared, active and passive movements were restored and the patient was able to walk. The malposition of the joints was corrected by tenotomies. While the specific effect of root section upon the spasticity was very positive, the ultimate functional results were far from satisfactory although it must be admitted the patient refused to submit to any course of systematic exercises.

CASE 6 (Gottstein). In a female epileptic 19 years of age, with right-sided spastic hæmiplegia, Gottstein resected the $L_2L_3L_5$ and S_1 roots; the operation had the desired effect upon the spasticity, immediately afterwards the leg was quite flaccid and in the course of a few days voluntary motion was restored.

It must be said, however, that the lesion was syphilitic, and considerable improvement was noted after a course of mercury.

CASE 7 (Clark and Taylor). An eleven year old boy mentally defective with a cerebral diplegia dating back to infancy, exhibited the typical paraplegic syndrome; although spasticity was marked he was able to walk without assistance. The $D_{12}L_7L_2L_3L_4L_5$ roots were resected on the left side only. The spasticity was greatly reduced, the crossed leg progression was succeeded by a straddling gait which improved somewhat by physical training.

CASE 8 (Taylor). In an eighteen year old feeble minded boy, with a typical infantile hæmiplegic syndrome, probably the result of intracranial hæmorrhage at birth, with the upper extremity in a birdwing contraction and spastic, the $C_4C_5C_6C_7C_8D_1D_2$ roots were resected. The arm was entirely relieved of spasticity and all the reflexes on affected side were intact. No statement is made as to the return of voluntary movements or of the restoration of function.

CASE 9 (Clark and Taylor). A boy 18 years old, a subject of epilepsy since infancy, with infantile cerebral hæmiplegia, was operated upon November 15, 1909; the $C_4C_5C_6C_7$ roots were resected. Before the operation the extremity was very spastic and there were mild grade athetoid movements. All spasticity was relieved and the athetoid movements disappeared entirely. The reflexes were preserved and in the five weeks that he was under observation the number of epileptic attacks were reduced. There is no report as to the return of voluntary movements or of the usefulness of the limb.

CASE 10 (Förster and Tietze). An imbecile boy, ten years of age, with congenital spastic paraplegia; the knees were in marked flexion, the extensors of knee were contracted, the thighs were flexed on trunk, strongly adducted, and in internal rotation. The only possible passive movement was slight flexion of leg on thigh. There was very little voluntary motion. The $L_2L_3L_5$ and S_2 were resected on both sides (January 11, 1907). Immediately the vicious position of limbs had disappeared, passive movements were possible in all directions. Later some voluntary movements were restored and the associated movements in the arm, back, and neck were abolished. The patient could get into bed, stand, and walk without support; he could walk backwards, sideways, and go up stairs. There was no ataxia and the sensation which disappeared after the operation did not return.

CASE 11 (Förster and Tietze). A boy of 9 years, somewhat idiotic, with congenital spastic paraplegia; he could neither sit, stand, or walk without support. The knee and thigh were in a state of chronic flexion; passive movements were extremely limited and voluntary movements were too slight, flexion at knee and hip joints and these only with associated movements in the opposite leg, upper extremity, back, and neck. Only three roots were resected, the L_2L_5 and S_2. The results were not as good as in preceding case, because only three instead of four roots were resected. However, passive movements were possible in all directions and there was some return of the voluntary motion. External and internal rotation, abduction, and adduction, Achilles tendon and ankle klonus, and right patellar reflex were abolished; the left patellar reflex and the Babinski on both sides persisted. The patient was taken from the hospital without receiving any after treatment; at that time he could neither walk nor stand alone. The case was complicated by a congenital dislocation of the hip; the joint contractures were relieved by tenotomies. A year later both extremities were in a normal position, passive movements were still present in all directions; the condition of the reflexes had not changed. Voluntary movements were extraordinarily good and the associated movements were conspicuous by their absence. The patient, possibly from lack of education, was still unable to walk or stand alone.

CASE 12 (Förster and Tietze). This case, a girl of eleven years, differed somewhat from the others in that the operation was performed for the relief of painful spasms in the leg following a tuberculous spondylitis. There was complete paralysis of the right and but little motion in the left leg. There were, however, marked contractures and spasticity in both extremities, active reflex associated movements, and involuntary movements, creating very painful spasms of long duration. This operation, the first of the series, was executed with some mishaps; in opening the dura, two roots not identified were cut; the L_3L_5 and S_2 were deliberately resected on the left side, and because of hæmorrhage only two, the L_3 and S_1 on the right. Passive motion at knee and hip joints quite fully restored; at first there were no voluntary movements, but later, particularly on the left side, the limbs could be moved quite freely in various directions. The patient could raise herself up, sit alone, and turn in bed, could stand and walk with aid of crutch, and could go up stairs with aid of hand rail. There was no disturbance of sensation. Reflexes not altogether lost.

The fourth of the Förster and Tietze series is omitted because the patient died. It was a case of multiple sclerosis with complete spastic paraplegia.

CASE 13 (Förster and Tietze). This patient was a hæmiplegic aged 45 years; there was marked muscular contractures and pronounced spasticity of the arm. Voluntary movements were quite limited. The $C_5C_6C_7$ roots were resected and immediately afterwards the arm was absolutely flaccid. Later there was some return of function, especially in flexors of fingers and pronators of hand; the forearm could be extended, and the action of the flexors of the forearm, the adductors and internal rotators, was fairly good, but on the whole the final results were anything but satisfactory. Reflexes were present but distinctly weaker.

What conclusions are justified? Without fear of contradiction it may be said unquestionably that section of the posterior roots relieves in most instances spasticity; this cannot be gainsaid, even when the spasticity is of the most extreme type and of long duration, in

adults and in children, whether of cerebral or of spinal origin. This statement is substantiated by all but one of the thirteen cases under consideration. From the practical standpoint it may be said that the spasticity is relieved to such a degree that resistance to passive motion is abolished and we can go still farther and say, that in most instances, the reflex associated movements, often a very annoying and distressing phenomenon, are also abolished usually together, and the reflexes formerly exaggerated become either normally active or less active than normal. They are not permanently lost but in exceptional instances.

What is of considerable importance, and, in striking contrast to such pre-existing methods as tenotomies and the like, the effects of root section are enduring. The report of the second case of the Förster-Tietze series is especially valuable as showing that even though more than a year had elapsed there was not the slightest return of spasticity. This is also true of one of my cases (case 1) operated upon over nine months ago. While perhaps there is no reason to anticipate recurrence in any case, its enduring effect is a matter of no small consideration, in determining the propriety of the operation in any given case.

I shall not attempt to discuss the sensory disturbances; suffice it to say that in some cases sensation was not disturbed at all, in some only partially, but in none, however, seriously enough to constitute a positive objection to the operation. The peculiar lack of uniformity in the results and the lack of conformity to our preconceived notions of the number of roots supplying a given area has been commented upon elsewhere.

Admitting that spasticity is relieved and that the faulty position of the joints can be corrected by tenotomies, to what degree is voluntary motion restored, and how much more competent is the patient to use the limb or limbs?

We have purposely left to the last this the most important, at least the most practical, aspect of the problem under consideration. Turning again to the records we find that of the thirteen cases voluntary motion was restored to a marked degree in seven cases; in one of these, however, the spasticity was only partially relieved, of the remaining six, in one no mention is made, in another the condition was unchanged, and in one the movements were fairly good on one side but not so good on the other.[1] It should be borne in mind, however, that the restoration of voluntary movements does not depend altogether upon the abolition of spasticity (Förster). Thus in one case after section of the first sacral root the contracture was only partially relieved, but a tenotomy of the tendon Achilles did not facilitate voluntary dorsal flexion of the foot. It may be true, as has been suggested, that the removal of the source of sensory excitation by root section abolishes the action of the cortical impulses upon the antagonistic group of muscles and thereby permits of voluntary movements. But to discuss the various hypotheses suggested by this theme would lead us too far afield, suffice it to say that root section restores voluntary movement but only in part by removing the spasticity.

With the knowledge that the exaggerated reflexes have been abolished, the spastic element controlled, and voluntary movements restored it might not seem illogical to conclude that the function of the extremity, and by that I mean the general usefulness of the limb, whether it be arm or leg, must be restored in large measure. Such a statement must be admitted with certain qualifications.

As in every lesion of the pyramidal tracts there is more or less muscular weakness, the degree of spasticity is no guide to the degree of muscular weakness, as a very slight pyramidal tract degeneration may cause an exaggerated degree of spasticity and a slight degree of weakness. The spasticity masks in considerable degree the motor power (Spiller). Therefore one cannot prognosticate before an operation with any degree of accuracy how much power there may be in the limb and how much restoration of function there will be after the spasticity is relieved. Case 1 is a case in point. Before the operation there was thought to be very much less impairment of muscle tone than was revealed after the operation; root section removed the spastic element to such a degree that were there no paresis, the patient would

[1] In two cases too little time has elapsed since the operation to admit of free voluntary movement.

have been able to walk with comparative ease and without support.

The restoration of voluntary movements by no means implies restoration of function in the sense of practical usefulness. A patient after an operation upon the lumbar roots may be able to execute very freely the movements of an ankle, a knee, and a hip joint, and yet be quite unable to stand or walk. Such were the circumstances in one case a year after the operation. The inability to stand or walk was attributed to the fact that the patient had received no educational exercises after the operation. This no doubt played some part and muscular weakness another, but whatever the cause the fact remains that in not one of the entire series could the results, as far as restoration of function is concerned, be said to be perfect. There is no doubt but the condition of the patient is much improved, but the character of improvement in my own cases and apparently in the others of the series was disappointing.

Indications. It is a matter of some importance, especially in the developmental stage of an operation, that some pains should be taken in selecting cases. In the first place an operation as formidable as a laminectomy with the necessary manipulation of the cord and its roots, should be reserved only for the severe grades of spasticity. It would be manifestly improper, for example, to advise an operation for a patient who could get about reasonably comfortably, could take care of himself, and was more or less independent. The bedridden case, the case which can walk only with great labor, or is unable to use either arm, should be regarded as a suitable subject. It matters not apparently whether the lesion is of spinal or cerebral origin. The lesion may be a congenital spastic paraplegia, a compression myelitis or a multiple sclerosis. Theoretically at least, it should make no difference whether the upper or lower extremities are involved, although according to Förster in the case of the upper extremity the prospects for the return of voluntary movement are not so bright.

Inasmuch as educational exercises are so important in the after treatment for the attainment of satisfactory results it follows that the patient with the highest degree of intelligence and will power will derive by far the greater benefit. In many cases of the congenital type the patient is often mentally defective and in not a few an epileptic subject. Irrespective of the influence this may have upon the end results we may well stop to consider the propriety of subjecting these wretched creatures to additional pain and suffering, unless — and this is worthy of consideration — the mental condition may indirectly be benefited, particularly in the case of children, where the results in the psychological clinic seem to show that manual exercises exert a beneficial effect upon the impaired mental state. I now have under my observation a case in which I should be influenced in deciding for or against operation by this very possibility.

As a therapeutic means for meeting a certain indication, section of the posterior roots might be looked upon as a specific for spasticity, quite as much so as section of the sensory root of the ganglion of Gasser for the relief of trigeminal neuralgia. I do not want to be understood in presenting the subject as in the least degree skeptical as to the merits of the operation. The idea is original and quite ingenious and as a physiological experiment, if I may use such a term, the results prove the correctness of the premises from which the operation was evolved.

Theoretically we abolish the contractures and restore approximately the normal range of excursion in the movements of the limb, we eliminate the disturbing flexor reflexes of the leg, and the equally disturbing reflex associated movements, which interfere with voluntary individual movements, we make provision for the return of voluntary motion and theoretically we should have brought about a condition which would enable the patient to use the limb for ordinary purposes. Practically, however, we find this to be true only to a very limited degree. It may be that sufficient time has not elapsed in many of the cases for the best results to be attained. Practice, education, muscular exercise continued over a longer period, may accomplish more than we have yet observed.

MANAGEMENT OF THE BREAST IN THE PUERPERIUM AND DURING LACTATION[1]

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As it would be impossible to enter into a discussion of the reasons for the methods of management of the different problems that arise in caring for lactation without taking up much more time than can be allowed to-night, I must content myself with presenting my own views on the various problems without justifying them by authority or records of clinical experience.

The proper management of the breast means developing and maintaining a normal lactation, that is, the securing of a sufficient supply of good milk to nourish the child. This implies a proper dietary and regulation of nursing, and involves the avoidance or proper treatment of all accidents to the breasts, especially infection, which might interfere with their function.

It is hardly necessary to speak of the importance of securing a normal lactation, for it is now generally admitted that breast milk is much better than any other food for the child.

Occasionally a mother should not nurse, and then lactation must be stopped. The indications for stopping lactation are, death of the child, lung and throat tuberculosis, and serious heart or kidney disease or other general disease that would make the drain of nursing a menace to the life of the mother. Unmarried women who have to give up their children must also be included in this list. These should nurse as long as possible in order to give the child a good start. Syphilis and acute infectious diseases are not generally indications for stopping nursing, neither is reappearance of menstruation.

Lactation can be stopped best at any stage by simply applying supporting bandages, as will be described presently, to prevent the discomfort due to the dragging down of the heavy breasts. If the patient is still in bed ice bags can be applied for a day or so when the congestion is most painful. If she is already around and the breasts become painful she should lie down at intervals in order to apply the ice. It is not necessary to use any ointments or internal medication, and breast pumps are not only unnecessary but undesirable. Proper massage, according to a technique to be given shortly, might be employed when the discomfort is great, but the ice applications are equally efficacious and less troublesome. There is absolutely no danger of infection or other injury to the breasts if they are let alone. The lay notion that the milk in the breast may become dangerous is absolutely unfounded. The small amount of milk in the ducts is quickly absorbed and the lymph surrounding the areolæ and small ducts soon disappears.

The antelactational treatment has for its object chiefly the preparation of the nipples to cleanse them from bacteria, which sometimes collect in large numbers under the crusts formed by the gravidal secretion, and to toughen them to resist the results of nursing. Daily washing with soap and warm water during the last month of pregnancy, with thorough drying and rubbing with a clean towel, is all that is necessary. A month of this treatment is sufficient to get the nipples in good condition. The bare possibility that the manipulation might start up labor would contraindicate much rubbing early in the pregnancy, and in women particularly liable to miscarriage. Both ointments and astringents seem to me to be unnecessary and undesirable. When the nipples are depressed, pumps and manual manipulation to draw them out are sometimes recommended. I have not had satisfactory results from this treatment. After lactation begins, the nipple can generally be evolved by proper manipulation and as readily when no previous treatment had been instituted, as when this had been done.

The proper time to begin the nursing depends on the needs of the child, the activity of the gland, and the condition of the mother. Pre-

[1] Read before the Chicago Gynecological Society, March 25, 1910.

mature children must have food shortly after birth, while a well developed child can get along without food for two or three days without danger. There is no doubt, however, that the earliest secretion, the colostrum, is of considerable value to the child and should be secured if possible. A good average rule is to put the child to the breast three to six times a day for the first two or three days.

On the second or third day, when the breast becomes congested on account of the distension of the lymphatics and blood-vessels supplying the secreting gland structures, there is generally more or less discomfort. This can be reduced in most cases by proper bandaging. The object of the bandage is support and not compression. It must be applied always so as to give relief and not cause more pain. This will be accomplished if it is applied so as to hold the breast to the front of the chest. The best form of bandage is made of strong muslin long enough to go around the chest and pin in front. It should be about sixteen inches in width with notches seven or eight inches deep for the shoulders over which the edges of the notches are pinned.

If the patient is very sensitive and not sufficiently relieved by the bandage, ice bags should be applied as directed when describing the management of the starting of lactation. Formerly I frequently employed massage for this purpose but lately I have almost discarded this manipulation because of the satisfactory results obtained by the ice.

Massage of the breasts, if employed at all, should be given in accordance with the principles and with the technique formulated in my paper previously presented to this society (Proceedings of the meetings of the Chicago Gynecological Society, March 21, 1902. Published American Journal of Obstetrics, volume 45, June, 1902) which consists in reducing the lymphatic and nervous congestion by rubbing away from the breast.

The pump is apt to be painful, its use is not founded on the right principle, and it should be avoided.

The rules for the frequency and length of nursing, after the establishment of the secretion, depend upon the amount of milk obtained by the child and the character of the secretion. The quantity of milk secured by the child may be determined if necessary by weighing the child before and after nursing, in a good scale that weighs to one-fourth ounce. The daily weight of the child generally furnishes a satisfactory index of the progress. A weekly gain of four to seven ounces we consider normal. To make this gain the child at term must take milk equal to about one-eighth of its weight per day and a premature child requires about one-sixth of its weight. This quantity can be secured by the normal term child in from seven to ten nursings, while a weak or premature child may need to be fed each hour or each hour and a half both day and night. As the quantity and character of the milk furnished by mothers differs, as well as the size of the child's stomach and the needs of the child, it follows that we can make no uniform rule for the frequency or regularity of the nursings, but the nurse or mother guided by the physician, should be able to determine the proper nursing schedule for each child. In hospitals it is true that babies do well with a uniform schedule, generally of ten nursings a day.

The length of a nursing is generally from ten to twenty minutes. If the milk comes freely and the child nurses vigorously eight or even five minutes may be sufficient. If the milk is abundant the breasts may be given alternately. If it is scant both breasts should be nursed every time. Here we generally put the baby first to one breast and then change it to the second and at the next feeding put it to the second first. Likewise when the milk is scanty we increase, not diminish, the number of nursings. The stimulation of the breast by nursing is one of the best ways to increase the amount of milk and decreasing the number of feedings is the best way to dry up the milk. Of course, if the baby does not get enough from the breasts its ration must be supplemented with cow's milk or other artificial food given after the nursing.

Does the quantity or the character of the milk depend upon the diet of the mother? To a certain extent, yes, but the diet is a much less important factor than is commonly supposed. A general mixed diet containing a fair amount of nitrogenous elements is best both for the quantity and composition of the secretion. A

fair amount of milk in the diet is desirable because it is itself a mixed diet, but it should not be carried to excess.

There is no objection to plenty of fruit in the ration. The studies of Baumm, in Breslau, as well as of numerous others, have shown that the common idea that fruits or other acid foods cause colic or other disturbances in the baby is unfounded. The only question concerning fruit and common vegetables is that of their influence on the digestion of the mother.

Cooking and serving is generally of more importance than the quantity or quality of the food in affecting the supply of milk. The nervous element is very important and a mental or moral disturbance generally affects very unfavorably the character and quantity of the secretion. Securing a favorable environment is therefore one of the most important duties of the medical attendant and nurse. This includes especially the management of a colicky baby so that it disturbs the mother as little as possible. It is a common practice among nurses and friends, sometimes also of the physician, to tell the mother that the colic of the baby is due to her milk. One of her first deductions is that she must stop nursing. This course may also be suggested by the attendants. This generally increases the mother's worry and makes the condition worse. The opposite course should be taken. The colic should be made light of and the disturbance of the baby kept from the mother as much as possible. The mother should be assured over and over again that her milk, even if not perfect, is the best possible for her baby and that it will soon improve. The constant worry about the harmful effect of fruits or other articles of diet kept up by the continual discussion of this subject should be put a stop to, and cheerful subjects for conversation and diversion substituted. Exhaustion from social or other duties should be avoided. In short, in these difficult cases of lactational disturbances the physician must often assume the rôle of a nerve specialist and lay out a careful plan of management as he would in a severe case of hysteria or other neurosis.

Unfortunately in these cases the chemical examination furnishes but little aid in the management. Not infrequently the sugar content is increased and sometimes the fat or protein elements. But the discovery of these facts helps us but little in the management. It is possible that the biological examination may in the future give more assistance, for it is probable that milk enzymes are more important digestive factors than variations in the chemical composition. At present we are as little able to change by diet the enzymes of the milk as we are the chemical content.

We have stated at the outset that the proper management of lactation involves the avoidance or proper treatment of infection of the gland and nipple. This phase of the subject will be considered under the following heads: *a.* Influencing factors. *b.* Sources of contamination. *c.* Method of preventing infection. *d.* Method of treating infection.

The length of nursing, the time it takes a child to get its ration, depends upon the supply of milk or the activity of the secretory gland and the ease of the flow. The size of the ducts may be a factor in determining the flow, but I think it is much less important than the activity of the gland. When the milk is poured out in abundance as soon as the stimulation of nursing is applied, I imagine that the child will have little difficulty in getting it. With a slow and deficient secretion the suction required and the length of the nursing will be much greater and the risk of injury and infection will be proportionally increased. This strong suction probably explains the blisters, varying in size from the head of a pin to that large enough to cover the end of the nipple, not infrequently seen on the nipple in the first day of nursing.

The character of the nipple, its size, the ease with which it is grasped by the child, is also an element in the duration of nursing. A depressed nipple, for example, may need a good deal of manipulation before it can be seized, and this of course increases the risk of infection. A nipple with fissures or furrows either longitudinal or transverse is easily eroded, so that a certain amount of infection is almost unavoidable.

A further factor influencing infection and determining its extent is the resisting forces of the maternal organism. This is a factor in all infection and depends on the general health,

degree of anæmia, and the immunity to the attacks of the germs likely to be found in the contaminating material.

The usual sources of contamination are the bacteria of the skin of the breast, whose numbers will depend upon the thoroughness of the previous cleaning, the dirt from the clothes coming in contact with the nipple, the dirt from the fingers of the nurse and mother when they "pull out" the nipple to help the child to take hold, the content of the mouth of the child, which is not usually of importance unless the child has thrush or other mouth disease, and the dirt or pus from the face or head of the child, which is of great importance if it has pustules or sore eyes. An occasional source of infection is also pus in one or more of the Montgomery glands.

The rules for the prevention of infection are easily formulated when the probable sources of infection are known, and the results of rules are determined from clinical experience. I have come to adopt the following:

The nipples and areolar regions are washed thoroughly with soap and warm water before the child is first put to the breast and afterwards at least once a day.

The nipples are covered with four thicknesses of sterile gauze, six to nine inches square, held in place by the breast bandage. These pieces are changed two times a day or oftener if necessary.

The nipples are washed with 60 per cent to 80 per cent alcohol immediately after nursing, by pouring two to three teaspoonfuls of alcohol over the nipple. This is the best antiseptic for the breast, as it is non-poisonous for the child and much more efficient than the usual boric acid solution. It is very good to heal any slight abrasion made by the child in nursing, and is used after the nursing for this purpose and because at this time the contaminating matter is present and most dangerous. Washing before nursing is not necessary if the breast has been properly protected.

Contamination from the fingers of nurse and mother is prevented by strictly forbidding either to touch the nipple. The nurse, professional or other, is continually busy caring for the napkins of the baby and the lochial and fæcal discharge of the mother, and her fingers are necessarily badly contaminated. It is not necessary to "pull out" the nipple for it usually erects spontaneously, and if not it may be stimulated to erection by manipulation of the breast outside of the areola. In case of depressed nipple or other condition, when it might be necessary for the nurse to handle the nipple she should wear gloves.

If the nipples are tender or blistered or become abraded after nursing, perhaps bleeding slightly, a glass shield with rubber nipple attached is used during nursing. This protection is almost always necessary with fissured nipples and very frequently once or twice with nipples that show no sign of abrasion. Depressed nipples can always be managed with a shield if sufficient time and patience is given. Attention must be given to the fit of the shield. The usual shield now on the market has a bowl that is rather small and frequently the mother's nipple is so large or long that it is pinched in it. We should not try to fit the nipple to the shield but rather make the shield to fit the patient. I have had larger sizes made to fit special cases. Occasionally the nurse has some difficulty to get the child to draw through the shield, but patience and perseverance, sometimes filling the bowl with milk to get the child started, will succeed, unless the child is feeble, and then of course it may be necessary to obtain the milk by manipulation or pumping and feeding it artificially for a short time.

In case a furrowed nipple becomes eroded in spite of the use of the nipple shield, the sore or ulcer should be healed as soon as possible. Immediately after nursing, diluted alcohol should be applied with absorbent cotton until the wound is thoroughly clean and then a thin layer of collodion applied carefully. This will protect the sore till the next nursing, when it will not interfere. Nursings in these cases should not be oftener than every six hours.

As the most dangerous source of contamination of the breast or nipple is undoubtedly pus from the head or face of the child, especial attention should be given to the child and particularly in cases of sore eyes or any kind of eruption. Here the face must be washed carefully before nursing. Many advise washing the mouth before nursing. This rule seems to me unnecessary and undesirable unless the

child has sore mouth. Ordinarily I believe the child's mouth cleanses itself. If pustules appear on the face or head they must not be allowed to break spontaneously and the contents become smeared on the surrounding skin. They should be opened after thoroughly cleaning with alcohol, and the contents expressed, the cavity cleaned as well as possible, and then covered with collodion. Sometimes more pus forms necessitating a second opening but this is not common, and leads to no more trouble than the original pustule.

The management of abscess of Montgomery's gland is similar to the management of the pustules on the child. It should be opened as soon as pus forms, or at least as soon as any danger of rupture appears, cleaned thoroughly, and sealed with collodion.

A slight infection of an eroded or fissured nipple without general symptoms is not uncommon. Thorough cleaning with alcohol and the use of the nipple shield will control and prevent the spread of the infection without stopping nursing.

A deeper infection of the gland is manifested in general symptoms. Whether apparently slight or severe at the beginning the treatment should be radical. Nursing should be stopped, supporting bandages put on if not previously used, and ice applied. If only one breast is affected the child may nurse from the other. The mother is to be assured that it will probably not be necessary to stop nursing from the sick breast for more than four days, and that she will not lose the milk. If she has been up around she should go back to bed in order that the breast may be kept better at rest and ice applied. All cupping, pumping of the breast, massage, and poulticing should be forbidden. These measures all interfere with rest, which is the principle of the treatment and which has proved sufficient to abort the trouble in at least 90 per cent of all cases, a better record than with any other method of treatment. When fever and tenderness have subsided then nursing may be resumed with care, not giving up the ice for two or three days longer.

If pus has formed already and the infection cannot be aborted, the bandage and ice will still furnish great relief from pain. Where the continuance of fever and local tenderness with perhaps indications of suppuration show that an abscess has formed it should be opened at once. Some form of local anæsthesia should be used in order that the operation is not made a serious affair. The incision should be small and a very small wick drain employed. This may be removed in from twenty-four to forty-eight hours.

A large suction cup employed during the dressing assists the drainage, and the artificial hyperæmia is here an aid in the healing. The ice and bandage are used in the intervals between the dressings.

THE ABDOMINAL WALL AFTER DELIVERY AND THE PREVENTION OF ABDOMINAL INSUFFICIENCY AND THE NEURASTHENIC STATE[1]

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THE abdominal wall plays a very important part in the well-being of the pregnant, parturient, and puerperal woman. By reason of its muscular and fascial development the normal intra-abdominal tension is maintained and the various abdominal and pelvic viscera are enabled to functionate properly. If the anterior parietes are weakened by pregnancy or other allied conditions increasing the intra-abdominal tension, various anatomic and pathologic disturbances ensue to which Glenard in 1885 proposed the term enteroptosis. Because of the relative frequency with which pregnancy antedates this latter condition in its milder or severer forms, its prevention becomes a matter of serious moment to the patient.

Two forms of abdominal insufficiency are now recognized. In the first class of cases, the entire muscular development of the individual is below par and this condition is associated with an inherent weakness of the visceral supports. This weakness is present at birth and generally persists unchanged throughout the life of the patient. Thus is explained the occurrence of pendulous abdomen and enteroptosis in young children and nulliparæ who have suffered from no centrifugal pressure. These cases are characterized by a flabbiness or hypotonus of the body tissues, by a lack of energy and, lastly, by a more or less pronounced backwardness of development. The patients complain of various nervous disturbances and belong to the marked neurasthenic type. These women not only develop enteroptosis frequently after childbearing, but their condition is not relieved by the usual surgical methods. Generally, all the abdominal organs are involved in the ptosis and operations on one or two of the viscera only leave the patient as great an invalid as before.

Closely allied with these cases of so-called infantilism are those women whose general condition has been reduced by disease, such as chlorosis, tabes, and other nervous states, chronic wasting diseases, tardy convalescence from acute disease, or who have been subjected to unhygienic conditions of life and insufficient exercise. In obese patients, the muscular development is often poor and these people have a greater tendency to abdominal insufficiency.

The most frequently observed type of cases is where the abdominal walls have yielded to a relatively permanent high intra-abdominal tension. As etiological factors, we find ascites, chronic distension of the intestines with gas, tumors, and most commonly pregnancy. The gravid uterus causes an increase in the intra-abdominal pressure to which the strongest muscular wall must yield, and unless the reparative changes after delivery are adequate, its tonus is permanently impaired.

Certain conditions associated with pregnancy are productive of an overdistension of the abdominal wall and, therefore, tend still further to reduce its resisting powers. Hydramnion, multiple pregnancy, various pelvic formations which prevent the engagement of the fœtal head, and deformities of the spinal column which diminish the distance between the ensiform cartilage to the pubis are classical examples.

A prominent factor in lowering the vitality of the abdominal wall is due to the general custom of wearing corsets. Corsets take away from the abdominal muscles the power of supporting the trunk and hence interfere markedly with their development. In many women with small waists, these muscles are atrophic and are so weakened by disuse as to be practically helpless in supporting the abdominal viscera. Furthermore, corsets prevent free respiratory movement and predispose to anæ-

[1] Read before the Chicago Gynecological Society, March 25, 1910.

mia and poor circulation. The custom of dispensing with corsets during the latter months of uterogestation is gaining in popularity. Nevertheless, many women still attempt to constrict the waist in the early months, with resulting injury to the growing fœtus as well as to themselves.

If a woman suffering from abdominal insufficiency becomes pregnant, she is relieved of many of her neurasthenic complaints when the intra-abdominal pressure is raised sufficiently by the growing uterus. A marked improvement is noticed in the alimentary canal; the bowels functionate regularly, gastric symptoms abate, and various aches and pains disappear. Generally, these troubles return after the patient leaves her bed in the puerperium, and the intra-abdominal tension is again reduced.

When the growing uterus finds itself crowded in the abdominal cavity, direct pressure outward is made against the termination of the fibers of the internal and external oblique muscles, the linea alba. A steadily increasing pressure always affects the musculature by lowering its elasticity. In marked disproportion between the gravid uterus and abdominal cavity or when pregnancies follow in rapid succession, stretching is associated with pressure atrophy of the muscles. The lateral muscles are especially weakened in these cases. As the linea alba yields to the abdominal tension, its tissues stretch and rectal diastasis occurs. The rectal muscles, however, because of their relative thickness and narrow width and their encasement in a firm fibrous sheath, and because they yield only to direct outward pressure, do not lose their tonicity to the same extent, except in cases of multiple pregnancy and hydramnion.

The effect of pressure on the lateral abdominal walls is often observed during laparotomies for abdominal tumors. If the tumor is large and of long standing, the recti and the iliocostal margin of the quadratus lumborum stand out prominently, while the intervening tissues are lax and sagging. If the tumor is of smaller size, the lateral walls are thicker and the longitudinal muscles are more difficult to palpate. This condition may also be elicited in the multiparous woman who has borne children rapidly. The examination is made at the seventh or eighth month of pregnancy with the woman lying down. Palpation reveals the strikingly prominent recti and the more or less rigid posterior muscles when brought into action. while the lateral walls are found to be relaxed and yielding. Beyond this test, we must depend upon the degree of stretching of the linea alba and the extent of rectal diastasis present to determine the presence of abdominal insufficiency.

In normal cases, the disproportion between the gravid uterus and the abdominal cavity is small. During pregnancy or the second stage of labor, the vitality of the recti muscles is not impaired except for a slight diastasis of from one to four centimeters. This disappears immediately after delivery or at most in the early days of the puerperium. The abdominal wall soon recovers its normal tonicity and recovery is complete. Many women pass through the ordeal of uterogestation with so little impairment to their tissues that it is difficult to believe that pregnancy had ever taken place.

In the milder form of abdominal insufficiency the muscles lose some of their tonus but show no changes in structure. They are simply overstretched. These women complain frequently of fatigue pains located in the lateral, anterior, or posterior muscles within a few hours after delivery. The muscles are tender on pressure. The diastasis is not marked and *the recti do not stand out prominently* when brought into action. If the patient lies in bed, she complains of no distress. The bowels functionate properly and the uterus gradually sinks into the pelvis. If the intestines overfill with flatus or the uterus remains high, muscular restoration is hindered and the diastasis is slow in closing. If this woman, however, leaves her bed and uses her abdominal pressure against the weakened structures the condition becomes more or less permanent.

In the second form of abdominal relaxation, we find pressure atrophy of the lateral muscles in addition to lowered vitality but with slight or no involvement of the recti. Some of the muscular bundles are separated from each other and many of the fasciculi and fibrils are torn across. Because of the tension, the blood

supply to the tissues is deficient and many fibers atrophy leaving only their sheaths and connective tissue bands. When these latter tissues are overstretched, the relaxation becomes permanent. In this condition, the recti muscles are somewhat widened and flattened. Their edges are not thickened or raised yet they respond quickly to the electric current and contract in the normal manner. *They raise themselves in a typical manner from the relaxed lateral walls.* The linea alba is stretched and bulges beyond the level of the recti. This form of relaxation is more common in multiparous women. As long as this woman lies in bed, she suffers but little. Overfilling of the intestines with flatus and fæces or the bladder with urine produces no disturbance. When the patient leaves her bed, she suffers at once from gastric symptoms, pressure and bearing down sensations in the lower abdomen and from meteorism. When standing in the erect position, the peristaltic movements of the intestines may be seen through the linea alba.

If this condition is of long standing or if the pregnancy is frequently repeated, the abdomen weakens until a general relaxation occurs in which the muscles and connective tissues are atrophic and relaxed. The symptoms often develop soon after delivery and reach their acme when the patient leaves her bed. She complains of backache, dragging and pain in the lower abdomen, sharp pain in the iliac region, feeling of pressure, gastric and cardiac disturbances, constipation, headache. Many of these pains are due to stretching and pulling of nerves coming from the lumbar and sacral plexuses. They are increased when the mesentery is filled with fat or when the abdomen is markedly pendulous and overhangs the pubis. It is a great mistake to maintain that these symptoms are due to some more or less minor pathology in the uterus or perineum, for suturing a torn perineum or replacing a displaced uterus is useless as far as relieving the patient from her suffering.

The prophylactic treatment of insufficiency of the abdominal walls begins in childhood in securing a competent and general muscular development of the entire body. A moderate amount of physical exercise is essential to good health. Constriction of the waist by corsets is to be avoided. The clothes should hang from the shoulders wherever possible. The abdomen should be allowed free room and free, unrestricted growth. Prolapse of the viscera is a rare event in women who wear no corsets, who do not tie the skirts tightly around the waist, and are accustomed to manual labor. It is a clinical fact that many women of the working classes who labor in the open air and live on plain but substantial food become so well developed physically that they suffer little if any from pathological conditions in the pelvis that would keep others bedridden.

Generally, the physician has to deal with two classes of pregnant women who give him much concern. In one is the wage earner or factory girl who possesses a narrow chest, is stoop shouldered, and is poorly fed and clothed. She frequently does not consult him until the advent of labor. In such instances, pregnancy and labor are often followed by ill health unless careful attention is given to the patient. In the other class, the well to do patient is suffering from a life of "excessive refinement," is abnormally sensitive to stimulation, lives on overrich but dainty food and drink, disdains physical exercise of every sort and degree and, in addition, is handicapped by the burden of fashionable dress. It devolves upon the physician to remedy these defects as far as possible, and upon his success will depend in large measure the future health of the patient.

When the child is born, the intra-abdominal tension is suddenly lowered, the uterus has a tendency to relax while the mesenteric vessels dilate and fill with blood. Both portal and lymph circulations are sluggish because both depend upon a relatively high intra-abdominal pressure. At this time we should not wait for symptoms to develop in the lying-in woman, but recognize the importance of restoring the abdominal walls as well as the uterus to the normal non-pregnant state. In many cases palpation shows evidence of abdominal insufficiency before a single symptom appears. At his daily visits, the physician should pay special attention to the degree of rectal diastasis present, the stretching of the linea alba, and the amount of intra-abdominal pressure, as from tympany. In the first class of abdom-

inal insufficiency, all that is necessary is to reduce the abdominal tension by relieving the bowels regularly of flatus and fæces, secure uterine involution, and prevent overdistension of the bladder.

If the lateral walls are atrophic and the recti separated, the binder should be used. A good binder applied early acts favorably in strengthening the weakened lateral muscles and often prevents complications. The binder should cover the entire abdomen from the costal margin to the os pubis. It should be well fitted and favor the apposition of the recti. The temporary restoration of the abdominal pressure affords great relief to the patient.

The question as to how long the puerperal woman should remain in bed is important. Certain German authorities following Küstner's advice get their patients up on the second to the fifth day post-partum. They leave the hospital on the seventh or eighth day and begin to work as soon as they return home. The majority of authors are more conservative and allow their patients to get the benefit of a well-merited rest at this important time, thus allowing the abdominal wall to recover somewhat before the increased pressure is brought to bear against it. It is a better plan to allow the patient to get up when the uterine fundus is no longer palpable in the abdomen, generally on the tenth day, when no perineal stitches or puerperal infection call for longer rest. During these ten days, the reparative changes are exceedingly active and the process of involution should not be interfered with.

To overcome the muscular soreness so often met with after labor, massage is of great benefit. Rubbing and kneading the muscles of the upper and lower extremities, back and abdomen, stimulate the blood and lymph currents, and give great relief. Massage of the abdomen assists materially in stimulating peristalsis, mechanically dislodging fæcal masses, and in hastening reparative changes in the abdominal walls.

In women predisposed to abdominal insufficiency, or whose abdominal walls are relaxed to the first or second degree, active exercises should be instituted early in the puerperium. All women suffering from lacerated perineum, sepsis, anæmia from post-partum hæmorrhage, or other serious accident of labor should wait a longer time before undertaking gymnastic work. These various movements aid in stimulating muscular activity in the abdominal walls, decrease the extent of rectal diastasis by contracting the interposed fascia,and strengthen the lateral muscles at a time when favorable results are more certain to occur. They tend to restore the intra-abdominal tension before a permanent relaxation of the parietes and subsequent ptosis of the viscera take place. To restore the intra-abdominal pressure temporarily by a well-fitting binder and to stimulate the reparative processes in the abdominal walls constitute the elective prophylactic treatment of abdominal insufficiency. In the primaparous patient one is able to restore fully the integrity of the abdominal muscles in the great majority of cases and these women are saved from many neurasthenic discomforts and ailments. In multiparæ, however, it is only possible to overcome the relaxation associated with the pregnancy just passed. Relaxation after former deliveries is permanent. In other words, we can prevent an aggravation of the condition existing prior to the recent pregnancy.

In selected cases, I direct the patient to perform the following movements, beginning on the third day of the puerperium:

1. The patient lying on the back flexes the right thigh upon the abdomen, keeping the leg flexed. The movement is slow and is repeated from 15 to 20 times. The left leg is exercised in a similar manner. Finally, both legs are exercised together. This movement is intended to bring the recti muscles into action.

2. While lying on the back the patient flexes the thigh upon the abdomen, keeping the leg extended. The movement is repeated with the other leg and then with both together.

3. While lying on the back the patient adducts and abducts both limbs alternately. She lies in the middle of the bed and aims to touch the lateral edges of the mattress with each foot. This movement brings the lateral abdominal and perineal muscles into activity.

4. The patient resting on the shoulders, elbows, and heels attempts to raise the abdomen and pelvis free from the bed.

These four movements may be practiced during the first week and should be continued

intermittently during the puerperium. They are especially indicated in primiparæ whose walls fail to unite after delivery.

In women suffering from the second degree of relaxation, where the recti stand out prominently from the lateral muscles or where the muscles as a whole are relaxed, additional exercises are recommended.

5. While lying on the back the patient raises herself on one elbow and partially turns or twists the chest to one side as if preparing to eat from a tray. The exercise is made slowly and the patient rests for a time on the elbow before returning to the dorsal position. The exercise is then repeated on the other side. This movement has the advantage of not interfering with a sutured perineum.

6. The patient while lying on her back raises herself into the sitting position. She then returns to her former position.

7. The patient lies on the abdomen and attempts to raise the lower limbs and head free from the bed. This exercise is omitted if the breasts are tender or large. It is a powerful stimulant to the dorsal muscles.

8. The patient lying on the back grasps the head of the bed with both hands and attempts to raise both lower limbs until the feet touch the head of the bed. This exercise is reserved for the third week. It is the most fatiguing movement of the group and is generally not required.

These various movements are practiced both morning and evening for a period of 15 to 25 minutes, but never to a point of exhaustion or fatigue. They should be continued throughout the puerperium until the active reparatory processes have ceased. It is unnecessary to state that the binder should be removed and the abdomen given free play at this time.

If a careful explanation is made to the patient as to the value of these movements in the avoidance of a "high stomach," most women will co-operate with the physician and excellent results will be obtained. In the lying-in wards of the Cook County Hospital, these patients invariably go through the exercises and make no objection whatever. From their standpoint, it breaks the monotony of an otherwise uneventful puerperium. Even in the women who speak only foreign languages or those whose mentality is below par, their co-operation in this form of treatment is commendatory. In private practice, I have yet to see a patient refuse this form of exercise.

The results to be obtained by this treatment are self-evident. The patients themselves assert that they feel benefited and stimulated thereby. They rest better, eat better, and are able to return to their work in better condition. It is a matter of daily occurrence to observe a rectal diastasis of from 5 to 7 cm. close up gradually, to see the flaccid muscles become strong and rigid and the general aspect of the women improve.

At each daily post-partum call in the hospital or in private work, the nurse, interne, or physician himself, as the case may be, determines the following points by abdominal examination. A diagnosis of the degree of relaxation is made on the first day. 1. The height of the uterus in centimeters above the os pubis. This measurement is taken by the pelvimeter. The progress of uterine involution is important, as the patient gets up when it is no longer palpable externally. If uterine involution is delayed, small doses of ergot and hydrastis are administered four times daily. 2. The degree of rectal diastasis present. This is given in centimeters. If the diastasis does not extend to the ensiform cartilage or os pubis, that fact is noticed. 3. The degree of tonus and resistance of the lateral abdominal muscles. Notice is also taken of the difference in tonus between the recti and lateral muscles. If this is marked, exercises strengthening those muscles are frequently repeated. 4. The degree of tympanitis. Tympanitis interferes with abdominal restoration and is to be at all times prevented. This point is marked on the history sheet by the letter T and the degree of tenseness. If the wall is excessively distended, the degree is marked 10. As the tension is reduced, the figures drop to 1, or if absent, to 0. This requires the personal equation of the examiner, but after a little experience, fairly credible observations may be made. Tympanitis is treated by enemata, cathartics, massage, and the salicylate of eserine. 5. The last point is pain in the abdomen. The abdomen is bisected by a line extending from the ensiform cartilage to the symphysis pubis. It

is again bisected by a line drawn perpendicular to the first and crossing the navel. This is marked on the history sheet by a large plus sign, +. If pain is felt by the patient either spontaneous or on deep pressure, that fact is noted by a small circle on the chart. The intensity of the pain is recorded as follows: Spontaneous pain so severe that the woman cries is marked 10. Pain on deep pressure that makes the patient wince is marked 5. Other degrees of intensity are marked proportionately. All exercises are forbidden when pain of any moment is present in the pelvis The patient lies quietly in bed, is placed in Fowler's position, is given ergot and hydrastis, and has ice compresses applied to the abdomen. Under this treatment, the pain disappears in a day or two and the exercises are commenced cautiously a few days later.

When the uterus has descended into the pelvis and cannot be palpated externally, the patient gets up from bed. She is instructed to walk when in the upright position. Sitting in a chair tends to relax the abdominal muscles. For the first few days, she should either walk around the room or lie down in the dorsal position. At this time, a well-fitting binder should be worn until the abdominal wall is able to withstand the intra-abdominal tension — a matter of from one to six months. When this condition is reached, binder is to be removed.

If the abdominal wall remains permanently weakened and neurasthenic symptoms develop, it is necessary to wear the binder for years, unless the patient is willing to submit to operative measures. In such cases, Webster's operation of shortening the diastasis by removing a portion of the intervening abdominal wall will give good results and permanently relieve many symptoms.

CONGENITAL STENOSIS OF THE PYLORUS

A Study of the Effect of Gastro-enterostomy upon Digestion and upon the Pyloric Tumor

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1. *The Generally Accepted Facts Concerning Congenital Stenosis of the Pylorus Stated*
2. *The Material Used—A Brief Report of the Cases of Congenital Stenosis of the Pylorus Operated Upon which Served as a Basis for the Following Investigation*
3. *The Effect of Posterior Gastro-enterostomy upon the Metabolism of the Body*
4. *The Persistence of the Pyloric Tumor after Posterior Gastro-enterostomy*

1. THE GENERALLY ACCEPTED FACTS CONCERNING CONGENITAL STENOSIS OF THE PYLORUS

THE autopsy and operative findings agree as to the conditions present in stenosis of the pylorus in infancy. The body of the baby is usually thin and wasted. There is a fullness in the upper half of the abdomen, a depression in the lower half of the abdomen. The pyloric tumor is about the size of the end of the thumb. There are never evidences of an inflammatory process in the neighborhood of the tumor.

The tumor is oval in shape; it is firm, almost hard in consistency.

The stomach itself is enlarged; even dilated. The stomach wall is often thickened, sometimes thinned.

The intestine is collapsed, empty.

Microscopical examination finds an hyperplasia of the circular muscular fiber at the pylorus. The longitudinal muscular fiber is little if any changed.

The tumor is formed by the hyperplasia of the musculature. The normal longitudinal folds of mucous membrane are hypertrophied in the pyloric segment of the stomach.

The lumen of the pylorus is diminished in size; it is obstructed by the pyloric tumor and the hypertrophied mucosa.

The clinical story is that of an obstruction more or less complete to the passage of the stomach contents into the duodenum.

Soon after birth vomiting begins in a breast fed boy baby. The character and time of the vomiting, the quantity and quality of the vomitus are significant.

Constipation with meconium-like dejections is present. Violent visible peristalsis of the stomach is noticed. The pyloric tumor is often palpable.

The cases of pyloric spasm without pyloric tumor must not be confused with the cases of pyloric tumor.

The prognosis in the cases of pyloric tumor is bad unless surgical measures for the relief of the obstruction are employed.

Certain cases of pyloric spasm without tumor formation recover under medical treatment. If the diagnosis can be made of a pyloric tumor causing obstruction, the earlier operation is performed the safer will it be for the baby concerned.

If the clinical picture is suggestive and a tumor cannot be palpated, operation should be done if the baby is losing weight and strength under skilled feeding.

Two objects are sought by operation: The overcoming of the obstruction at the pylorus occasioned by the pyloric tumor in order to meet the emergency of starvation, and the restoration of the intestinal canal so that it may serve the individual satisfactorily the remainder of his life.

The Loreta, a pyloroplasty, and a posterior gastro-enterostomy are the operations of choice. Personally I prefer a posterior gastro-enterostomy, and this is the operation which has been done in the cases which are reported here.

These are the facts which are accepted by those interested in congenital stenosis of the pylorus. The picture is seen to be that of a disease with a unique pathology, an obstructive symptomatology, and of an unfavorable prognosis if surgical measures are delayed, and with brilliant results if early mechanical treatment is adopted.

TABLE I. CASES STUDIED IN THE FOLLOWING INVESTIGATION

No.	Name	Age at Operation	Present Age & Wt.	Present Condition
1	Wales — Patient of Dr. Townsend. Operation by Dr. Scudder.	14 days Artificially fed	5 Years. 44 lbs.	Health perfect
2	Larrabee — Patient of Dr. Ilsley. Operation by Dr. Scudder.	24 days Breast fed	4¾ years 37¼ pounds	Health perfect
3	Colby — Patient of Drs. J. L. Morse and Day. Operation by Dr. Scudder.	22 days Breast fed	3½ years 33½ pounds	Health perfect
4	Stevens — Patient of Dr. Charles Putnam. Operation by Dr. Scudder.	25 days Artificially fed	2½ years 31½ pounds	Health perfect
6	Nutting — Patient of Drs. Cook and J. L. Morse. Operation by Dr. Scudder.	7 weeks, 5 days Breast fed	1½ years 27 pounds	Health perfect
7	Matthews — Patient of Drs. Elam and J. L. Morse. Operation by Dr. Scudder.	5 weeks Breast fed	1½ years 21 pounds	Health perfect
8	Hyams — Patient of Drs. J. L. Morse, Dunn and Swain. Operation by Dr. Scudder.	7 weeks, 4 days Breast and art. fed	11 months 20¼ pounds	Health perfect
9	Harrington — Patient of Drs. Straw and J. L. Morse. Operation by Dr. Scudder.	4 weeks, 4 days Breast fed	2 months 6 lbs., 6. oz.	Gaining Health perfect
a	Arnold — Operation by Dr. Hough, New Bedford, Mass.	10 weeks	3½ years	In fine condition.
b	Burke — Operation by Dr. Oliver, Cincinnati, Ohio.	6 weeks, 1 day	1⅞ years	Strong and healthy
c	Martin — Operation by Dr. Oliver, Cincinnati, Ohio.	7 weeks, 1 day	1⅞ years	Health good
d	Sawyer — Operation by Dr. Bunts, Cleveland, Ohio	5 weeks	2½ years	Well and "hearty"
e	Smith — Operation by Dr. Kingsbury, Hartford, Conn.	10 weeks, 2 days	2 years	"C'ldn't be better"
f	Thomas — Operation by Dr. Bunts, Cleveland, Ohio	5 weeks, 3 days	11 months	"Gained steadily"

2. A BRIEF REPORT OF THE CASES OF CONGENITAL STENOSIS OF THE PYLORUS OPERATED UPON, WHICH SERVED AS A BASIS FOR THE FOLLOWING INVESTIGATION

Case 1. Wales.[1] A patient of Dr. C. W. Townsend of Boston, and Dr. West of Newton Center, Mass. The operation was done by Dr. C. L. Scudder. A boy baby. Weighed at birth 10 pounds, 11 oz. He was artificially fed and vomited shortly after birth. The vomitus was the milk taken at a feeding. The vomitus contained no bile. The vomiting was expulsive in character and occurred immediately after each feeding. He lost 2 pounds in weight before the operation. At operation tumor was seen and palpated at pylorus. A posterior gastro-enterostomy was done when he was 14 days old. This is the youngest recorded recovery after gastro-enterostomy for congenital pyloric stenosis. He weighed 33 pounds plus when he was 3 years and 2 months old. He is now in perfect health. His diet is that of a healthy child for this age. He has always been inclined to constipation.

Weight May 18, 1910, 44 pounds.

Case 2. Larrabee.[2] A patient of Dr. Ilsley of Medford, Mass. The operation was done by Dr. C. L. Scudder. A boy baby. He was breast fed. He vomited soon after birth and constantly until the operation on the 24th day. The vomiting occurred usually after several feedings and came in spurts. Gastric peristalsis was observed after each feeding. No tumor was felt. The child lost in weight and strength. At operation tumor was seen and palpated at pylorus. The operation was a posterior gastro-enterostomy. At the present time he is 3 years and 8 months old and is in perfect health. His weight at birth was 6¾ pounds.

General diet: Milk, eggs, broths, never meat excepting chicken occasionally. Bread, crackers, potatoes, Ralston food, cereals, peanut butter, butter, celery, turnips, fruit.

Weight, May 24, 1910, 37¼ pounds.

Case 3. Colby.[3] Patient of Dr. J. L. Morse of Boston and Dr. Day of Newburyport. The operation was done by Dr. C. L. Scudder. A boy baby. He began to vomit when he was 16 days old and the vomiting was constant until the operation on the 22d day. The material vomited was the milk taken. The vomitus contained no bile. The baby was breast fed. He had lost in weight. Gastric peristalsis was observed. A pyloric tumor was felt. At operation tumor was seen and palpated at pylorus. The operation was a posterior gastro-enterostomy. The child is now 2 years and 5 months old and is in good health. His bowels are never constipated.

His diet consists of milk, soft boiled eggs, steak, lamb,

[1] First reported in the Boston Med. and Surg. Jour., December 14, 1905.

[2] First reported in the Boston Med. and Surg. Jour., February 22, 1906.

[3] Reported in the Boston Med. and Surg. Jour., August 6, 1908.

and broths, butter, bread, cereal, potatoes, macaroni, puddings and fruit.

Weight, May 18, 1910, 33½ pounds.

CASE 4. Stevens.[1] A patient of Dr. Charles Putnam of Boston. The operation was done by Dr. C. L. Scudder. A boy baby. The child was breast fed and artificially fed. He began to vomit when he was 14 days old. The material vomited was the milk taken. The vomitus contained no bile. Gastric peristalsis was evident. No pyloric tumor was felt. The operation was done when he was 25 days old. At operation tumor was seen and palpated at pylorus. The operation was a posterior gastro-enterostomy. At 10 months old the child weighed 20¼ pounds. He is now 2 years and 4 months old and weighs 31½ pounds. He is in perfect health.

His diet consists of 35 oz. of Eskay's food and milk, 2 oz. of cereals, and some fruit for a day's allowance. He is inclined to be constipated, and laxatives have to be used a good deal.

CASE 6. Nutting.[2] A patient of Dr. Cook of Fitchburg, Mass., and Dr. John L. Morse, of Boston. The operation was done by Dr. C. L. Scudder. A boy baby. He began to vomit at 4 weeks and 5 days old. He weighed at that age 8½ pounds. The movements were normal in color. The character of the vomiting was explosive. The vomitus consisted of the milk taken at a feeding. The vomitus contained no bile. There was very marked gastric peristalsis felt through the abdominal wall. A pyloric tumor was indistinctly felt in the region of the pylorus. At operation tumor was seen and palpated at pylorus. A posterior gastro-enterostomy was done when the child was 7 weeks and 5 days old. His weight at the time of the operation was 6 pounds and 4 oz. At the end of 3 months after the operation he weighed 11½ pounds. He seems to be in perfect health.

The food given immediately after the operation was breast milk and a home modification. The food at present consists of a mixture of top milk, cream, peptogenic milk powder, lime water, and boiled water, 4 oz., given every 2 hours, approximately.

Weight May 29, 1910, 27 lbs.

CASE 7. Matthews. A patient of Dr. Elam of Gardner, Mass., and Dr. John L. Morse of Boston. The operation was done by Dr. C. L. Scudder. A boy baby. He weighed 6 pounds at birth. He was breast fed and seemed in good health for the first 3 weeks. He increased in weight to 7 pounds and 12 oz. When he was 3 weeks old he began to vomit about an hour after each feeding. The material vomited was the milk taken at a feeding. The vomitus contained no bile. The character of the vomiting became explosive. There was a loss in weight of ½ pound in the ten days previous to the operation. A pyloric tumor was easily palpable. There was marked gastric peristalsis. At operation tumor was seen and palpated at pylorus. A posterior gastro-enterostomy was done when the child was 5 weeks old. He is now perfectly well. The food taken is breast milk.

[1] Reported in the Boston Med. and Surg. Jour., August 6, 1908.

[2] Reported in the Boston Med. and Surg. Jour., March 4, 1909.

Weight, May 18, 1910, 21 pounds.

CASE 8. D. H., Jr. A patient of Drs. Morse, Swain, and Dunn, of Boston. The operation was done by Dr. C. L. Scudder. A boy baby. His weight at birth was 9 pounds. He began to vomit when he was 6 weeks old. At that time he weighed 10 pounds and 11 oz. Breast feeding was discontinued immediately and artificial feeding begun. At the time of the operation he weighed 8 pounds and 11 oz. The vomitus contained specks of bile. The amount vomited was the whole of a feeding. The stools were meconium-like. Gastric peristalsis was visible. A characteristic tumor was palpable. At operation tumor was seen and palpated at pylorus. A posterior gastro-enterostomy was done at 7 weeks and 4 days of age. The child is now in perfect health. He is 10 months and 24 days old, and weighs 20¼ pounds, May 18, 1910.

CASE 9. W. F. H., Jr. A patient of Dr. Straw of Manchester, N. H., and of Dr. John L. Morse, of Boston. The operation was done by Dr. C. L. Scudder, April 22, 1910. A boy baby. He weighed 7½ pounds at birth. The baby was breast fed. He began to vomit when he was 16 days old. For the next two weeks he was fed a mixture of whey and modified milk, with a rectal feeding of peptonized milk every 2 hours. He had occasional cyanotic attacks. He had dilatation of the stomach, collapsed bowel and meconium-like movements. He had lost much flesh. His general condition was poor. At operation tumor was seen and palpated at pylorus. The operation was done when he was 4 weeks and 4 days old. The operation was a posterior gastro-enterostomy.

The child recovered from the anæsthetic satisfactorily and took within the first hour 1½ drams of milk and retained it. The first days following the operation there was difficulty in keeping the baby alive. He was so feeble that for one 24 hours life seemed to be fast fading away. Warm water bottles, no bathing, moderate stimulation, judicious feeding, salt solution, and castor oil placed the baby on a living basis. To-day when 2 months old he has gained almost his birth weight, looks well, is strong, and is rapidly improving.

Weight, May 18, 1910, 6 pounds, 6 ounces. A gain of 1 pound in one week. June 20, 1910, is gaining at the rate of 2 ounces a day in weight.

CASE a. Dorothy Arnold, 3 years, March, 1909. A patient of Dr. Hough of New Bedford, by whose courtesy I am permitted to report the case. A girl baby. She weighed at birth a little over 9 pounds. At the time of the operation when 10 weeks old, she weighed 7 pounds. The symptoms were typical. The vomiting was at first frequent and explosive; later, as the stomach dilated it was less frequent but larger in quantity. There was visible gastric peristalsis. The child was emaciated. No tumor was felt. At operation tumor was seen and palpated at pylorus. The operation, a posterior gastro-enterostomy, was done by Dr. Hough. The child's recovery was without untoward symptoms. There was great trouble at first about feeding. She is now 3 years old and is in excellent condition. She weighs 32 pounds.

Her diet while the specimen was being taken con-

sisted of milk, chicken, lamb, steak, broths, fish, butter, rice, bread, cereals, potatoes, crackers, macaroni, puddings, fruit, and cocoa.

CASE b. Howard Burke. Born February 3, 1908. A patient of Dr. J. C. Oliver, of Cincinnati, Ohio, by whose courtesy the case is reported here. A boy baby. Weight at birth was 10¼ pounds. The weight at the time of the operation was 8 pounds. The child had vomited for 3 weeks. The vomiting had increased in frequency. Gastric peristalsis was visible moving slowly from left to right. At operation tumor was seen and palpated at pylorus. Operation was done when the child was 6 weeks and 1 day old. The operation was a posterior gastro-enterostomy and was done by Dr. Oliver. Recovery was without untoward symptoms. The child seems at the present time strong and healthy. He is 14 months old and weighs 29 pounds.

The fæcal specimen was taken at 11 months old and the baby weighed at that time 25 pounds. The diet consisted of one quart of milk, one pint of water, one ounce of Mellin's food, with occasionally a taste of vegetables, for a twenty-four hours' allowance.

CASE c. Baby Martin. A patient of Dr. E. W. Mitchell, Cincinnati, Ohio. The operation was done by Dr. J. C. Oliver, of Cincinnati, Ohio. The case is reported here by the courtesy of Dr. Oliver. A girl baby. At operation tumor was seen and palpated at pylorus. The operation was a posterior gastro-enterostomy. The child gained rapidly in weight for the first 3 months after the operation. Since then the gain has been slow and irregular. Health has been good except for a gastro-intestinal disturbance of considerable severity during the summer. Patient is now 16 months old and weighs 17 pounds.

While securing the specimen, the diet consisted of milk, cream, beef juice, oatmeal, zweiback, stale bread, butter, rice, orange juice.

CASE d. Sawyer. A patient of Dr. Sawyer of Cleveland, Ohio. The operation was done by Dr. Bunts of Cleveland, Ohio, by whose courtesy the case is here reported. A boy baby. The operation, a posterior gastro-enterostomy, was done when the patient was 5 weeks old. At operation tumor was seen and palpated at pylorus.

With the exception of a severe attack of measles the baby "has progressed well and is now a hearty child, practically as well as any child of its age, able to eat and digest such food as a child of its age should."

The age when the specimen was sent was 1 year and 11 months. The food taken when the specimen was being taken was as follows: Soft boiled eggs, beef broth, milk, crackers, junket, prunes, for each of the 3 days.

CASE e. Olcott D. Smith, Hartford. A patient of Dr. I. W Kingsbury, of Hartford, Conn. The operation was done by Dr. Kingsbury, by whose courtesy the case is reported here. A boy baby. The weight at birth was 8 pounds. At the time of the operation he weighed 9 pounds and 10 ounces. At operation tumor was seen and palpated at pylorus. The operation was done when he was 10 weeks and 2 days old. The operation was a posterior gastro-enterostomy and was done by Dr. Kingsbury. Preceding the operation the symptoms were vomiting, constipation, and loss of weight. The child is now 1 year, 6½ months old and weighs over 24 pounds. His general condition "could not be better."

The diet while securing the specimen consisted of milk, eggs, minced chicken, cereal, toast, hominy, Educator crackers, prunes, and orange juice.

CASE f. Irving Thomas, Cleveland, Ohio. A patient of Dr. Luck of Cleveland, Ohio. The operation was done by Dr. Bunts, of Cleveland, by whose courtesy I am permitted to report the case. A boy baby. The weight at birth was 7½ pounds. The weight at the time of the operation was 5 pounds and 1 ounce. At operation tumor was seen and palpated at pylorus. The operation was a posterior gastro-enterostomy, and was done when the child was 5½ weeks old. The symptoms were vomiting, spasmodic contraction and dilatation of the stomach. Gastric peristalsis was visible. There was suppression of urine, and absolutely no bowel movement.

Following the operation there was vomiting for 3 or 4 days. The temperature reached 101 degrees. There has been a steady gain since the operation. He has no gastric disturbance. There is some constipation. He is now 5 months old, and weighs 11 pounds.

This clinical material — these cases of proved pyloric stenosis — I have used as a basis for an investigation into the effect of gastro-enterostomy upon digestion and the futured of the pyloric tumor. The results of this investigation I wish to present at this time.

Eight of the cases I have personally operated upon and followed with the greatest care. Five of the eight cases have been reported elsewhere. Three of the eight, namely (7) Matthews, (8) Hyams, and (9) Harrington, I am reporting here for the first time.

In order to increase the value of this investigation it seemed wise to secure a little more clinical material than the 8 cases which I personally had had under observation. Consequently through the courtesy of four other surgeons in different cities I have been able to add to these cases of my own six others, making a total of 14 cases.

All of these 14 cases were utilized in the investigation into the effect of gastro-enterostomy upon digestion. Only my own cases were utilized in the investigation into the future of the pyloric tumor.

It will be noted, from the reports of these cases detailed above, that in every instance a pyloric tumor having all the classical signs was palpated and inspected. Moreover, in every case the clinical course of the disease manifested itself as an obstruction to the exit

TABLE II. ABSORPTION OF FAT AND NITROGEN FOLLOWING GASTRO-ENTEROSTOMY

(Cases of Paterson.)

No.	Time after Operation	% Fat Absorbed	% Nitrogen Absorbed	Lesion	Operation
1	5 months	92.3	91.0	Gas. ulcer	Ant. gas. ent.
2	7 months	92.5	90.5	Perf. ulcer	Ant. gas. ent.
3	24 months	92.7	92.1	Sten. pylor.	Ant. gas. ent.
4	2 months	94.7	92.7	Gas. ulcer	Ant. gas. ent.
5	1 month	93.5	92.4	Sten. pylor.	Ant. gas. ent.
6	1 month	92.3	91.2	Gas. ulcer	Post. gas. ent.
7	.....	95.4	92.2	Duod. ulcer	Post. gas. ent.
8	.....	94.1	93.5	Gas. ulcer	Post. gas. ent.
9	24 days	96.8	92.4	Gas. ulcer	Post. gas. ent.

of food from the stomach into the duodenum. In all of these cases the baby was gradually starving to death.

It seems to me of importance to lay especiai emphasis upon the demonstrable obstructing tumor which appeared in each of these cases. These cases belong to the group of pyloric obstructions due to tumor and not to spasm of the pyloric muscle. How much the element of spasm was present in these tumor cases it is, and always will be, impossible to say. It is sufficient for our present purpose that a demonstrable pathological obstruction existed. The element of spasm, if present at all, was of minor importance.

3. WHAT IS THE EFFECT OF GASTRO-ENTEROSTOMY UPON THE METABOLISM OF THE BODY?

In any metabolism experiment the estimation of the nitrogen and fat in the stool, the ingested material being known, should give a fair estimate of the digestion and absorption of the protein and fat.

Work already done. Joslin,[1] Boston, in 1897, working in Ewald's laboratory, recorded the first experimental work to show digestive capacity after gastro-enterostomy. Joslin found that in two cancer patients operated for pyloric obstruction, the digestion of proteids and fats was greatly impaired. In two cases the unabsorbed nitrogen reached 12.66 per cent and 19.9 respectively of the nitrogen taken in the food. The fat lost in the fæces in one case reached 18 per cent and in the other case 31.2 per cent of the fat taken in the food.

[1] Berliner klin. Woch., 1897, p. 1047.

The results were obtained upon cancer patients and in one case no control experiment was made. I think, therefore, that the results should be accepted as final only for the individuals concerned. No conclusions should be drawn from these two carcinoma cases bearing on the digestive process following gastro-enterostomy for benign obstruction.

Paterson,[2] in 1907, determined the nitrogen and fat in the stool in nine cases of benign disease of the stomach upon whom gastro-enterostomy had been done. See table II. An increase in the nitrogen loss in the stool may properly be interpreted as a lack of digestive power to care for the proteins. An increase in the fat in the stool may indicate a loss of power in the digestion of fats. Taking the whole series of nine observations, the average diminution of nitrogen is 1.7 per cent, and the average diminution of fat absorption is 1.9 per cent, while in every instance the variation is within the limits found in healthy individuals.

Cameron,[3] in 1908, determined metabolism facts in seven cases, and concludes (a) that in non-malignant cases after gastro-enterostomy there is a slight but definite diminution in the power of digesting and absorbing fat; (b) that on a milk diet (rich in fat) this diminution in power disappears; (c) that the complete digestion of fats in a milk diet is due to the specific stimulating effect on the pancreas of a hormone produced by the fats themselves. These are most important experiments recorded upon gastro-enterostomy cases.

It occurred to me that these babies with

[2] Jour. A. M. A., August 24, 1907, pp. 657–661.

[3] British Med. Jour., January 18, 1908.

TABLE III.

Name.	Age at operation.	Age at time specimen was sent.	Total weight.	Total dry weight.	Per cent nitrogen in dry stool.	Per cent total fat in dry stool.	Per cent neutral fat in dry stool.	Per cent fatty acid in dry stool.	Per cent soaps in dry stool.	Per Cent of Total Fat of		
										Neutral fat.	Fatty acid.	Soaps.
(1) Wales	14 days	3 yrs. 5 mos.	205	32.308	4.80	49.4	22.4	14.8	12.2	45.3	30.0	24.7
(2) Larrabee	24 ,,	3 ,, 8 ,,	185	42.865	5.60	26.8	11.2	8.4	7.2	41.4	31.3	27.3
(3) Colby	22 ,,	2 ,, 5 ,,	180	34.8	6.10	16.6	6.0	6.2	4.4	36.1	37.2	26.7
(4) A. F. S.	14 ,,	1 ,, 4 ,,	250	34.935	3.78	17.6	2.4	5.2	10.0	13.	29.0	58.0
(6) Nutting	7 wks. 5 days	5 mos.	64	13.503	2.80	38.0	10.8	7.2	20.0	28.4	18.	53.6
(*a*) Arnold	10 wks.	3 yrs.	240	51.004	4.80	37.8	11.2	7.4	19.2	29.6	19.6	50.8
(*b*) Burke	3 ,,	1 yr.	155	34.484	2.90	20.8	6.2	4.0	10.6	29.8	19.1	51.1
(*c*) Martin	50 days	1 ,, 6 mos.	85	18.344	5.20	44.0	16.4	20.4	7.2	37.2	46.3	16.5
(*d*) Sawyer	.....	.....	280	75.288	2.40	42.2	10.4	5.0	26.8	24.6	11.9	63.5
(*e*) Smith	72 ,,	1 yr. 6 mos.	135	30.334	4.06	38.2	10.6	14.2	13.4	27.7	37.1	35.2
(*f*) Thomas	5½ wks.	5 mos.	75	11.004	3.10	34.4	6.6	4.0	23.8	19.1	11.3	69.6
(7) Matthews(1)	5 ,,	5 wks.	5	.876*a*	4.40	57.8	29.2	17.4	11.2	50.5	30.1	19.4
,, (2)	5 ,,	5 ,,	?	3.649*b*	5.46	37.0	10.2	20.8	6.0	27.5	56.2	16.3
,, (3)	5 ,,	5 ,,	?	.802*a*	5.86	12.2	5.2	3.6	3.4	42.6	29.5	27.9
,, (4)	5 ,,	6 ,,	15	2.335*b*	6.06	21.6	7.0	7.4	7.2	34.2	33.4	33.4
,, (5)	5 ,,	6 ,,	19	2.090*b*	5.23	21.2	7.6	6.4	7.2	35.8	30.1	34.1

(*a*) Excreted during 24 hours. (*b*) Excreted during 72 hours.

congenital pyloric stenosis might serve for metabolism investigations into the effect upon digestion of a posterior gastro-enterostomy.

In these babies we have ideal conditions for such an investigation. The babies are healthy in all particulars excepting for the pyloric obstruction. Each case presents a functionating stoma.

Consequently, I asked Dr. Fritz B. Talbot of the Harvard Medical School, to make certain analyses for me of the fæces and food of two groups of babies. The group numbered 1 to 9 was operated upon by me, the group numbered *a* to *f* was operated upon by different surgeons. I wish to thank these gentlemen for their kind co-operation in this series of experiments. The names of the surgeons furnishing me with the cases in this second group are given with the details of the cases. Securing a few cases additional to my own group afforded a little more material and has enhanced the value of the returns. The chemical details, excepting those from one case, have just been recorded by Dr. Talbot.[1]

The object of this investigation has been to determine whether or not gastro-enterostomy performed on these babies with a demonstrable pyloric stenosis modified in any particular the digestion of fat, starch, and protein. I quote from the metabolism findings. See table III.

"The work of Camerer, Hartmann, Escherich, and Rubner shows that the quantity and quality of the food ingested may cause wide variations in the amounts of fæces excreted. The weights of the stools of these patients after gastro-enterostomy when compared with these figures all come within the normal limits. In comparing the total weight of stools passed per day with those for corresponding ages selected by Schmidt and Strassburger, the results do not show a great variation from the normal.

"The percentage of nitrogen is also influenced by the quality of the food given. According to Biedert, it varies from 4.23 per cent of the dried stool in bottle-fed babies to 5.28 per cent of the dried stool in breast-fed babies. The percentages are somewhat higher on the average adult diet, ranging from 5 to 8 per cent. If these figures are representative of all normal conditions, the percentages of nitrogen in the above table are within the variations of the normal. Three only approach the highest limit. It is safe to say, therefore, that none of these specimens show a marked increase in the amount of protein excreted."

In the case of Matthews, case 7, a special

[1] Boston Med. and Surg. Jour., Nov. 25, 1909, and April 14, 1910.

TABLE IV. THE NORMAL ABSORPTION OF FAT ON A MILK DIET

(Determined by Different Observers.)

Amount of Food	Grams of Fat in Food	Grams of Fat in Fæces	Percentage of Fat in Fæces	Percentage of Fat Absorbed	Age and Sex	Experimenter
1,790 cc. milk	53.7	1.50	2.8	97.2	F. 12	Camerer
2,039 cc. milk	54.4	1.60	2.8	97.2	F. 10	Camerer
2,050 cc. milk	79.7	5.70	7.1	92.9	M. adult	Rubner
2,200 cc. milk	69.1	4.93	7.2	92.8	M. adult	Muller
2,438 cc. milk	95.1	4.66	3.3	96.7	M. adult	Rubner
3,075 cc. milk	119.9	6.70	5.6	94.4	M. adult	Rubner
4,100 cc. milk	160.0	7.40	4.6	95.4	M. adult	Rubner
3,000 cc. milk	94.2	6.57	6.9	93.1	M. adult	Rubner
3,000 cc. milk	111.8	5.65	5.1	94.9	M. adult	Prausnitz
2,632.4 cc. milk	93.4	4.97	5.04	94.96	M. adult	Prausnitz

TABLE V. THE NORMAL ABSORPTION OF NITROGEN ON A MILK DIET

(Determined by Cameron.)

Number of Cases Examined	Milk Pints	Average Number of Grams of Nitrogen in Fæces	Percentage of Nitrogen Absorbed
6	4	0.84	93.82
4	4½	0.76	95.03
2	5	1.06	93.76

effort was made to secure all stools and samples of breast milk for a period of about one week immediately following the operation of gastro-enterostomy. The baby was five weeks old. In this instance the total fat in the dry stool which at first was 57.8 fell quickly to normal. Thus this adjustment resembled much the normal adjustment of fat excretion after birth.

In this whole series muscle and connective tissue were looked for in unstained cover-glass specimens and starch was looked for in specimens stained by Lugol's solution.

The chemical and microscopical examinations of these stools show that in most of the cases the digestion is normal. The protein was not markedly increased in amount in any of the stools and it was normal in the majority of cases. See table V. The percentage of fat in three cases was higher than normal. Excepting these the total amount of fat excreted in one day was within normal limits. See table IV.

I wish to call especial attention to case 8 for the conditions were ideal for the metabolism experiment. It was possible to obtain a sample of milk each day, to know the exact amount of milk ingested and to obtain all the stools excreted.

The accompanying table gives a summary of the findings. See table.

Case 8. Male baby. Operation at 6 weeks. Metabolism experiment at 5½ months.

	Am't Ingested in 3 days of Milk	Am't Excreted in Stools in 3 days	Percentage Utilized
Fat	60.233 gm.	1.713 gm.	97.2
Nitrogen	6.334 gm.	.126 gm.	98.1

In case 9, a recent case, I have secured, also through Dr. Talbot's co-operation, a metabolism experiment, so far as careful work is concerned comparable with case 8. In this case the qualitative and quantitative analyses of milk were made.

Case 9. Male baby. Operation at 4 weeks. Metabolism experiment at 2 months.

	Am't Ingested in 3 days of Milk	Am't Excreted in Stools in 3 days	Percentage Utilized
Fat	44.28 gm.	1.044 gm.	98
Nitrogen	3.211 gm.	.076 gm.	98

CONCLUSION

These figures obtained from an examination of 14 babies after gastro-enterostomy for

Fig. 1. Case 1. Photograph taken 2 years, 10 months following a posterior gastro-enterostomy. Weight 33½ pounds.

Fig. 2. Case 2. Photograph taken 2 years, 7 months following a posterior gastro-enterostomy.

Fig. 3. Case 3. Photograph taken 6 months following a posterior gastro-enterostomy. Weight 16 pounds.

Fig. 4. Case 4. Photograph taken 2 years, 3 months following a posterior gastro enterostomy.

Fig. 5. Case 6. Photograph taken 9 months following a posterior gastro-enterostomy.

Fig. 6. Case 7. Photograph taken 11 months following a posterior gastro-enterostomy.

congenital pyloric stenosis indicate that the digestion and the absorption of the fat and the nitrogen are practically normal. See tables IV and V.

These facts are evidence that the operation of gastro-enterostomy does not materially change the ultimate disposition of the two food components, fat and protein. If to the chemical evidence be added the clinical facts that all of these babies without exception are thriving and in apparently perfect health, that they have lived several years since the operation was done, have gained in weight, in height, and in every way have seemed

Fig. 7. Case 8. Photograph taken 4 months following a posterior gastro-enterostomy.

Fig. 8. Case a. Photograph taken 3 years following a posterior gastro-enterostomy. Weight 35 pounds.

Fig. 9. Case b. Photograph taken 1 year, 3 months following a posterior gastro-enterostomy. Weight 30½ pounds.

well and happy — if these carefully observed clinical facts are considered — the evidence is overwhelming that in these human babies gastro-enterostomy has no ill effect upon metabolism as measured by the digestion of fat, protein, and starch, and normal growth and development. See photographs of many of these babies. Figs. 1 to 9 inclusive.

The now generally accepted conception of the workings of the gastro-intestinal canal as an orderly sequence of related events, each dependent on what has preceded, explains the wonderful adaptation of the canal to changed conditions. Digestion is a closely linked chain of events. The questions raised by Cannon[1] arise: To what extent will a defective process at one part, or the actual removal from function of one part of this closely related mechanism, be compensated at another point? Can parts of the alimentary canal adapt themselves when special demands are placed upon them?

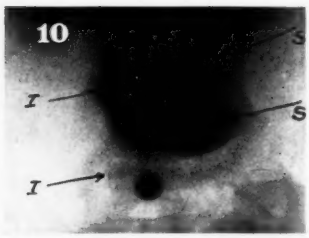
The investigations quoted and the experiments here recorded make it clear that the alimentary canal has the power of adapting itself satisfactorily to the changed conditions of an obstructed pyloric outlet and the presence of a patent gastro-enterostomy stoma. The researches of Pawlow, Wertheimer and Bayliss, and Starling and Cannon explain why the altered route taken by the chyme does not impair digestion.

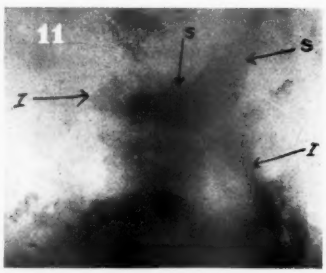
To the many already recognized factors of safety of the animal organism is added the manifestation of another in the wonderful adaptability of the gastro-intestinal tract — to markedly abnormal conditions. The physiological and the clinico-physiological facts agree.

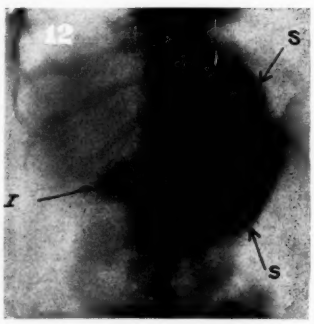
4. DOES THE PYLORIC TUMOR PERSIST AFTER THE OPERATION OF GASTRO-ENTEROSTOMY?

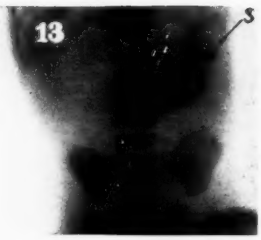
At first thought this might be considered a question of merely academic interest. It is a question, however, of very considerable practical importance.

[1] Boston Medical and Surg. Jour., January 27, 1910.









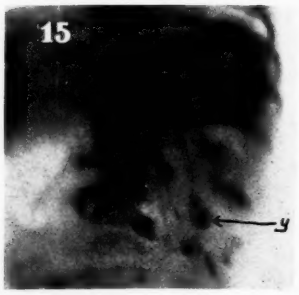


Fig. 10. X-ray of adult stomach (same as Fig. 11) at a later period after injection of bismuth food. Note that median line is crossed by shadow and that food has appeared in the intestine below stomach, having passed through the pyloris and duodenum. S, Stomach. I, Intestine.

Fig. 11. Same case as Fig. 10. X-ray of adult stomach containing bismuth food 25 minutes after feeding. Note that median line is crossed by shadow. S, Stomach. I, Intestine.

Fig. 12. X-ray of normal stomach of an adult. Note that the shadow of the bismuth crosses the median line, i. e., it is seen to be at the pylorus and in the beginning of the duodenum. S, Stomach. I, Intestine. Patient of Dr. Golthwaite.

Fig. 13. Baxter. Case of Dr. J. S. Stone, Boston, Mass. X-ray of stomach containing bismuth food *previous* to posterior gastro-enterostomy. Note that although the bismuth food has been swallowed 4 hours previous to the time of taking this X-ray none of the bismuth has left the stomach. It cannot pass the obstructed pylorus. S, Stomach.

Fig. 14. Matthews. Case 7. X-ray of stomach containing bismuth food, 1¼ years following a posterior gastro-enterostomy. Note shadow of food in stomach and intestine. Some shadow across median line to right side.

Fig. 15. Matthews. Case 7. X-ray of stomach containing bismuth food 1½ years following a posterior gastro-enterostomy. Note shadow limited to left side and intestine.

(*Legends continued on opposite page*)

There is no doubt that gastro-enterostomy relieves the acute starvation of these babies. This is evident by the immediate and rapid increase in weight after operation. Temporarily, then, at least, the stoma functionates.

Does it continue to serve as the outlet to the stomach? Does the obstruction of the pyloric tumor continue or is it gradually lessened until the pylorus becomes patent? Does the tumor persist or does it disappear?

In order to assist in determining these facts I have been fortunate in securing through Dr. Walter J. Dodd of Boston, Skiagrapher to the Massachusetts General Hospital and Instructor in the Rœntgenological Dept., Harvard Medical School, admirable X-rays of six of the eight children operated upon by me and recorded here. The conditions under which these X-rays were taken were as follows:

The child was taken to Dr. Dodd with an empty stomach. The child was given a small quantity of the mixture (10 ounces of milk, 1 ounce bismuth subcarbonate) of milk and bismuth subcarbonate. X-rays were then taken about 5 minutes after swallowing the bismuth. and at intervals of from 8 to 10 minutes thereafter. Great care was taken to have the adjustment of the tube and plate and child's body alike in each case. The child lay prone with the plate under him.

The legends of these plates sufficiently explain them. In each case no food is seen passing to the right of the median line.

If these plates are compared with two other plates here reproduced, their significance will be appreciated.

Figures 10 to 12 inclusive show normal stomachs and the food passing from the pyloric end out through the pylorus into the duodenum.

Figure 13 shows the stomach of a baby with pyloric stenosis before operation. This is a unique plate taken by Dr. A. George of Boston, of a case of Dr. James S. Stone, Boston, Mass. The baby was given bismuth with milk. The plate is the last of a series and was taken after 4 hours had elapsed. The bismuth is still seen in the stomach. It has not passed across the median line. Most significant is the fact that none of the bismuth has found its way after four hours into the jejunum. Assisted by the X-ray a positive diagnosis of pyloric stenosis was made. A posterior gastro-enterostomy was done. The baby is gaining steadily in weight.

These X-ray plates, then, show bismuth food under three conditions: (a) in the normal stomach passing well over the median body line into the duodenum, see Figs. 10 to 12 inclusive; (b) remaining after four hours in the stomach obstructed by a pyloric tumor, see Fig. 13; and (c) in the stomach and passing through a stoma from the stomach to the jejunum and in the jejunum in 6 cases demonstrated to have had a tumor obstructing the pylorus, see Figs. 14–27 inclusive. No food is seen positively passing the pylorus.

The plates from each of these six cases show almost the same appearances, i. e., food passing the stoma. The plates were taken at different times following operation, $1\frac{1}{4}$ years, $1\frac{1}{3}$ years, $2\frac{1}{4}$ years,3 $1\frac{5}{2}$ years, $4\frac{7}{3}$ years, and 5 years, respectively.

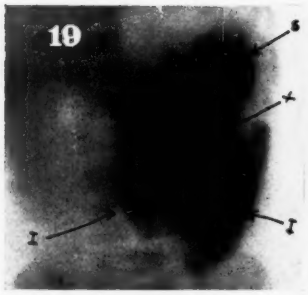
Kelling (1) in 1900 first demonstrated that the fluid chyme under the great intragastric pressure [von Pfungen (2) and Moritz (3)] in the pyloric part of the stomach takes its normal passage through the patent pylorus rather than through the artificial stoma of the gastro-enterostomy. Cannon and Blake (4), Tuffier (5) and Delbet (6) have confirmed these observations by means of the X-ray. Berg's (7) experiences with two human individuals having duodenal fistulæ make the conclusions upon lower animals properly applicable to the human animal. It is a generally accepted fact therefore that if the pylorus is patent chyme is forced through the pylorus rather than the artificial stoma.

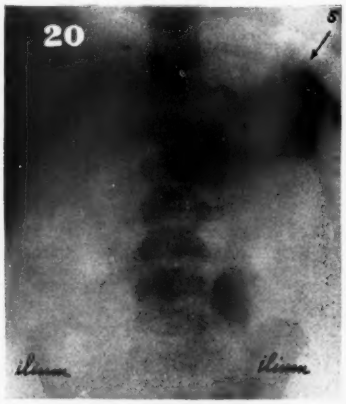
In view of the animal experimental results the converse of the proposition is reasonable,

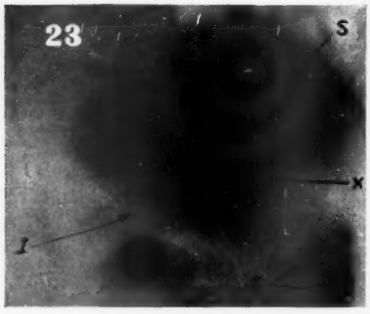
Fig. 16. Nutting. Case 6. X-ray of stomach containing bismuth food $1\frac{1}{2}$ years following a posterior gastro-enterostomy. Note no shadow at pylorus and duodenum, suggestion of stoma at "X."

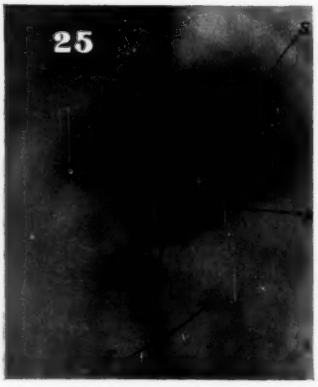
Fig. 17. Matthews. Case 7. X-ray of stomach containing bismuth food, $1\frac{1}{4}$ years following a posterior gastro-enterostomy. Note shadow of food in intestine and stomach, none passing pylorus. Suggestion of stoma at "X."

Fig. 18. Stevens. Case 4. X-ray of stomach containing bismuth food $2\frac{1}{4}$ years following a posterior gastro-enterostomy. Note shadows are all practically to the left of the median line. S, Stomach. I, Intestine.









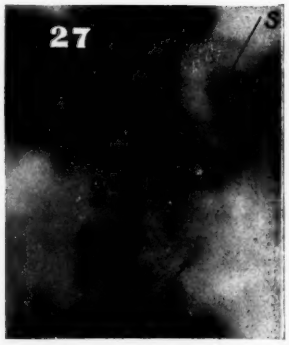


Fig. 19. Stevens. Case 5. X-ray of stomach containing bismuth food 2⅓ years following a posterior gastro-enterostomy. Note food shadow at stoma "X" and in intestine below. S, Stomach. I, Intestine.

Fig. 20. Colby. Case 3. X-ray of stomach containing bismuth food 3½ years following a posterior gastro-enterostomy. Note a later X-ray with more food in intestine and no shadow of food leaving the pylorus.

Fig. 21. Colby. Case 3. X-ray of stomach containing bismuth food 3½ years following a posterior gastro-enterostomy. Note shadow of food in intestine and no shadow of food passing duodenum. S, Stomach. I, Intestine.

Fig. 22. Colby. Case 3. X-ray of stomach containing bismuth food 3½ years following a posterior gastro-enterostomy. Note shadow wholly to the left of the median line. S, Stomach.

(*Legends continued on opposite page*)

viz., if food is seen by the X-ray to pass readily through the stoma of the gastro-enterostomy the pylorus is obstructed. In these congenital stenosis cases the X-ray demonstrates that the stoma functionates, therefore the pylorus which in these cases was found to be obstructed by the tumor at operation, after the lapse of months and years is still obstructed. Probably the cause of the obstruction also persists. The tumor in these 6 cases of congenital pyloric stenosis continues to obstruct after years of short circuiting.

Bearing upon the persistence of the pyloric tumor after operation mention must be made here of the pathological evidence in the unique case of Morse-Murphy-Wohlbach.[1] The facts are these: A boy baby with pylorics tenosis diagnosed by Dr. J. L. Morse, was operated upon by Dr. F. T. Murphy by a posterior gastro-enterostomy. The pyloric tumor was seen and was palpated. The child lived 7½ months weighing then 19 pounds. During this time the baby had developed as a normal child, was breast fed, had not vomited, and had had normal movements. When 8 months old the baby died of nothing connected with the operation. Fortunately a complete autopsy by Dr. Wohlbach was secured. The artificial stoma was found patent and functionally efficient. The pyloric tumor — and this is the point of present especial interest — persisted and appeared as at the time of the operation. Microscopical study found the tumor to be a true tumor of circular muscle hypertrophy. This is the only instance of congenital pyloric stenosis that has been studied so long as 6½ months following a successful gastro-enterostomy.

The X-rays just described taken together with this historic case go a long way toward establishing the fact that organic infantile pyloric stenosis, in certain cases at least, is a permanent condition.

The results of the pathological investigations of Maier[2] and Landerer have been adduced to demonstrate that some of the stenoses of adults have their origin in infancy and are really congenital. These facts of Maier are unassociated with clinical evidence and consequently can only be suggestive.

If the tumor remains unchanged, the basis for surgical treatment seems to have an added breadth. A short circuiting of the obstruction not only saves the baby from starvation but provides a restoration of the intestinal canal which is needed for the proper development of the child.

Koplik[3] records a case which is interesting in this connection. A baby was operated upon for a pyloric tumor stenosis by gastro-enterostomy. For 18 months approximately the baby did well, thrived. Now, about two years after the operation he has symptoms of a closure of the gastro-enterostomy opening, namely, vomiting of ingested food. If these observations are correct, the case is another bit of evidence that the pyloric obstructing tumor persists, for the closure of the stoma is immediately followed by a recurrence of the vomiting probably due to the obstruction at the pylorus.

[1] Boston Med. and Surg. Jl., clviii, No. 15, pp. 480–483, April 9, 1908.

[2] Virchow's Arch., cii, p. 413.

[3] Amer. Jour. Med. Sciences, cxxxvi, No. 1, July, 1908, p. 1.

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Fig. 23. Larrabee. Case 2. X-ray of stomach containing bismuth food 4¾ years following a posterior gastro-enterostomy. Note similar findings as those in the previous figure. S, Stomach. I, Intestine. X, Stoma.

Fig. 24. Larrabee. Case 2. X-ray of stomach containing bismuth food 4¾ years following a posterior gastro-enterostomy. Note the definite stoma location and food seen coming through it. No shadow of food in the duodenum next to the pylorus. S, Stomach. I, Intestine. X, Stoma.

Fig. 25. Larrabee. Case 2. X-ray of stomach containing bismuth food 4¾ years following a posterior gastro-enterostomy. Note the bismuth leaving the stoma at "X" the bismuth food in the intestine at "y." S, Stomach. I, Intestine.

Fig. 26. Larrabee. Case 2. X-ray of stomach containing bismuth food 4¾ years following a posterior gastro-enterostomy. Note the bismuth has left the stomach; as faintly shown at "X" is the stoma. S, Stomach. I, Intestine.

Fig. 27. Wales. Case 1. X-ray of stomach containing bismuth food 5 years following a posterior gastro-enterostomy. Note the shadow of the bismuth is to the left of the median line. Bismuth is seen in the intestine. S, Stomach. I, Intestine.

CHRONIC GASTROMESENTERIC ILEUS[1]

By ALBERT L. STAVELY, M. D., Washington, D. C.

CHRONIC gastromesenteric ileus is a subject which has received little consideration and is comparatively undeveloped. It has been my good fortune to have two well marked cases, which were verified by operation and which are of sufficient interest to justify their presentation. While gastromesenteric ileus was known to Rokitansky in or prior to 1842, it was not until Fagge reported his cases in the "Guys Hospital Reports of 1872 and 1873" that the condition was fully described and appreciated as a clinical entity.

H. Campbell Thompson in 1902 discussed the subject rather exhaustively and stimulated much interest. Since then the literature of acute gastromesenteric ileus has grown enormously. Laffer, in an article entitled "Acute Dilatation of the Stomach and Acute Arterio-Mesenteric Ileus"[2] has made a most elaborate review of the subject and his bibliography includes 194 references. We are now thoroughly familiar with the acute form, and its early recognition has been the means of saving many lives; but the chronic demands more attention and I believe, when our experience becomes less embryonic, we will find a different classification for some of those conditions, which are now mistaken for motor and secretory functional disorders of the stomach and displacements. There are a few points regarding the anatomy, which might be mentioned. The root of the mesentery extends from the left side of the second lumbar vertebra downward toward the right sacro-iliac synchondrosis. It contains within its layers the superior mesenteric artery and the accompanying veins and nerves, the first of which plays such an important part in bringing about an obstruction. Its insertion varies, sometimes being to the left, sometimes to the right and again on the anterior surface of the spine. Normally the peritoneum does not extend behind the duodenum, but sometimes, according to Dwight, a fold is found between the duodenum and the aorta, which adds to the mobility of the former. The transverse portion of the duodenum, in addition to the natural fixation produced by its peritoneal investments, is held in place by a rather variable musculofibrous band, the suspensory ligament of Treitz, which makes it one of the most immovable structures in the abdomen.

The etiology of gastromesenteric ileus is much confused. A large number of theories have been advanced and a large amount of experimental work has been undertaken to demonstrate some of them; but, as it is impossible to explain all cases by any one theory, one perhaps rationally concludes there must be a number of factors concerned in its production. Without attempting to analyze the merits of these various views, it may be of interest to consider the most important. There are many, who think there is a primary disturbance of the nervous mechanism of the stomach, induced by the anæsthetic, the operation, or the disease; that at first there may be nervous irritability indicated by frequent retching and vomiting, to be followed later by a paralysis, which results in gastric transudates and dilatation. The dilated stomach presses downward upon the intestines, which in turn cause traction on the mesentery. By some it is thought the simple pressure of a dilated stomach against the duodenum is sufficient to cause the obstruction. Kelling, after considerable experimenting, concludes there must be an obstruction, not only at the duodenum, but that there is at the œsophageal end a mucous fold or valve and that there is a valve-like action, which is aided by the pressure of the distended fundus against the left side of the œsophagus. He maintains he has been able to produce duodenal flexion in some subjects by distension of the stomach with water. Others have not been able to reach Kelling's conclusions; so experiments along these lines seem to be more interesting than definite.

[1] Read before the Alabama State Medical Society, April 20, 1910.

[2] Annals of Surgery, March and April, 1908.

Rokitansky was the first to advance the view that obstruction might be caused by the mesenteric ligament and was supported later by Glenard, Byron Robinson, Albrecht and others. Glenard and others have demonstrated the presence of a pressure upon the duodenum at the mesenteric ligament, which is normal and has a physiological purpose, the retaining in the duodenum of the biliary and pancreatic secretions long enough to permit of their free admixture with the food, which later passes in from the stomach and overcomes the obstruction.

Byron Robinson, writing in 1900,[1] shows an unusual familiarity with a subject which at that time was comparatively new. He states that the theory of gastroduodenal obstruction, as caused by the constriction of the mesenteric ligament, is entirely new with himself; but he had overlooked the work of Rokitansky and Fagge. He, however, has probably given the subject a significance not before attributed to it, the possibility of the constriction being responsible for chronic effects and cites cases, which I will refer to later.

A. J. Ochsner[2] offers another explanation for the retardation of bile and pancreatic juice in the duodenum. He recognized a marked thickening of some of the circular muscle fibers of the duodenum, always below the opening of the common duct. Sometimes they were like a broad band, sometimes like a sphincter. He thinks their presence will explain some of the stomach symptoms present in gall-stone disease.

It had been observed in some of the cases of gastroduodenal dilatation that the distension does not always extend to the mesenteric ligament and this may furnish the explanation. In a large number of cases it has followed the administration of anæsthetics.

Laffer, in a table of 217 cases, found it had occurred after operation 97 times and 60 of these were abdominal. He found it most frequent after operations on the gall-bladder, next most frequent on the kidney, and third, on the appendix.

Müller believes the chief cause to be the dorsal recumbent position, aided by the debilitating effect of the operation and purging. It may follow acute injuries, and both acute and chronic wasting diseases. The previous condition of the stomach and the character and quantity of the food that goes into it is of etiological importance. Age and sex have little bearing. It occurs most frequently between 20 and 40 years of age and women on account of their tendency to ptoses probably suffer more often.

It has been abundantly demonstrated by experiments that the traction on the mesentery by the prolapse of the collapsed small intestines into the pelvis is often sufficient to prevent the flow of fluids and gases through the transverse duodenum. Glenard estimated the pull of the empty intestines at 500 grams. There are certain anatomical variations, which predispose to or prevent its development. A long mesentery will permit the small intestines to fall into the pelvis without much traction. A mesentery less long might be a source of trouble. Prolapse of the small intestines into the pelvis, it must be understood, is not always associated with gastromesenteric ileus. The origin of the insertion of the root of the mesentery at the right or left of or on top of the spine may influence the amount of pressure on the duodenum.

Snitzler has tried to prove that duodenal obstruction occurs more readily, when the ligament is attached to the right of the median line.

The root of the mesentery may be broad like a band or constricted like a cord; and in the latter instance obstruction is more likely to occur. Something depends upon whether the mesentery is much folded or spread out. An abundance of fat helps to distribute the pressure and lessens the amount of obstruction. Spinal deformities such as lordosis and scoliosis predispose and it has been noticed several times that the application of a plaster jacket in these cases precipitated an attack. Prolapse of the stomach, transverse colon, or kidney by pressing upon or kinking the duodenum, the existence of a large hernia or a prolapsed uterus by permitting greater dragging, and a relaxed abdomen are favoring influences.

In a fairly careful review of the literature I have endeavored to assemble the information and opinions pertaining to the chronic form of

[1] Lancet Clinic.
[2] Am. Jour. Med. Sc., July, 1906.

the disease and have been able to collect 7 cases, in which the diagnosis of gastroduodenal dilatation was established through operation or autopsy. In some others, while such a condition was not suspected the history points strongly toward ileus. Undoubtedly the list may be greatly enlarged; but in the absence of definite operative or autopsic findings and with rather vague clinical descriptions of a condition which was not known to exist, the data must be rather inaccurate and unreliable.

Kundrat[1] in 1891 expressed his belief in the existence of an incomplete, but constantly acting obstruction from the mesenteric ligament, which resulted in the dilatation of the duodenum and the stomach.

Laffer describes a case, where after labor a woman developed an acute gastromesenteric ileus, which was relieved, only to occur again after an interval of three days with death resulting. He refers to a case of Leugeu's and to one of Tuffier's, where after a much longer interval, some months, there was recurrence. Albrecht[2] comments on the relative harmlessness which might be caused by a slight obstruction. He thinks that in many of these cases of apparently acute dilatation there has been a pre-existing chronic dilatation, which is dependent on mesenteric constriction and which results in a complete obstruction with all the symptoms of acute mesenteric ileus.

Connor[3] considering these views, says unfortunately for this theory, there is little evidence either in the clinical or autopsy records, which supports the idea that chronic gastric dilatation is a frequent antecedent to mesenteric obstruction. He says nothing is known of the clinical manifestations of such a chronic obstruction; but calls the attention of surgeons to the desirability of making a careful examination of the duodenum and mesenteric ligament in all operations in the upper abdomen.

Deaver[4] says that chronic dilatation is occasionally seen. He has seen this condition in a number of gastric and biliary affections and has little doubt that many patients, who have symptoms of pyloric obstruction, where the pylorus has been found to be patulous, are found to be suffering from dilatation of the duodenum.

Codman[5] is a strong advocate of the injurious effects of chronic obstruction. He says in proportion to the degree of pressure, the muscular contraction of the duodenum will drive its contents immediately past the obstruction or they will force the contents against the pylorus and come in contact with the first part of the duodenum or a certain amount may be forced through the pylorus itself, or there may be a regurgitant paralysis and vomiting. If the obstruction is extreme and the pylorus resistant, back pressure will force the fluids up the common bile duct and bacteria may develop there. He believes the theory of partial obstruction by the root of the mesentery will explain some clinical conditions better than those already advanced. To quote farther, "People vary greatly in their discomfort in ordinary digestion, even though digestion be perfectly completed. The extreme cases without physical signs are called nervous dyspepsia and hyperchlorhydria. Perhaps such cases may suffer from duodenal distension and their duodenal peristalsis may be constantly overtaxed, because they happen to have more pressure at the root of the mesentery than other people. In such cases the distension is mainly with gas, which occasionally leaks through the pylorus into the stomach, causing eructations. In other cases, however, the fluid contents may flood the first portion of the duodenum and cause more or less acute distress. It is in cases of this sort that lack of exercise and outdoor life play an important part. In other words, a more unrestricted life allows the mesentery to move about more and relax its pressure." Without intending to consider the acute form, it may be well for the sake of comparison to describe very briefly its most important symptoms

In the first place they may be insignificant and there is no doubt many unsuspected cases of moderate degree have recovered. A typical severe attack develops about as follows: After an operation persistent or frequent nausea and vomiting may develop. Pains, which are almost invariably present, may be well dis-

[1] Wien. med. Wochensch., 1891.
[2] Arch. fur Path. Anat., bd. 156, S. 285, 1899.
[3] Am. Jour. Med. Sc., vol. cxxxiii, p. 345.
[4] Surg. of the Upper Abd., 1909.
[5] Bost. Med. and Surg. Jour., clviii, 503.

tributed, but are generally confined to the epigastric region. After a time, it may be hours or days, the pain lessens and the character of the vomiting changes. Instead of the ordinary ejections of an irritated stomach, there are discharged by regurgitation rather than by active vomiting large quantities of a dark green or brown fluid. The intervals between regurgitations depend upon the degree of paralysis of the stomach.

The quantity of fluid ejected may amount to several pints at a time. With the establishment of complete paralysis the patient feels easier, the pain may cease and aside from the intense prostration and great thirst, he complains very little. The condition rapidly becomes worse, the patient shows in his facies and rapid emaciation the serious state into which he has sunken. The temperature may not be affected, the pulse becomes rapid and the respirations quickened. The urine becomes scanty. Clay colored stools may exist from the absence of bile there. Death from collapse finally ends the scene in a few hours or after a day or two. Exceptionally the patient may last a longer time and possibly lapse into a chronic state. Relapse is possible. It was noted by Laffer in five cases. In some cases the stage of initial gastric irritation and retching is short or absent on account of the rapid onset of the paralysis. In some cases there is no vomiting or marked gastric distress. In others with no vomiting the condition is exceptionally grave, because the stomach fills up with no hope of relief from pressure. Conner says that in some of the cases he investigated dilatation subsided very gradually in the course of weeks and once a moderate degree of distension persisted.

In chronic cases the symptoms are less pronounced, the obstruction is less complete and all or a fair amount of food may be retained and assimilated. In the milder degrees of distension there may be little to attract attention to the real condition. Dyspepsia is the usual diagnosis. There is a variable amount of distension of the stomach and duodenum, which may be recognized without trouble in spare subjects, some pain or discomfort after eating and possibly some nausea and vomiting. In the more marked cases the stomach may distend quite suddenly shortly after taking food, the pain becomes severe and the nausea and vomiting is marked. The vomitus may or may not contain bile. After the attack of vomiting the patient is easy or easier, until more food or liquid is taken. Pain sometimes occurs without the vomiting. There is another variation of the symptoms as evidenced by Bloodgood's case and some of the others. His patient suffered constantly with indigestion and eructations of gas; but during the course of a year she had five major attacks, which consisted of pain in the left side with nausea and vomiting.

If the stomach reaches the stage of complete paralysis, which may be considered exceptional, the vomitus becomes voluminous and dark colored. Rather it is in a state of irritability, which may be associated with a varying amount of dilatation.

These patients through a process of deficient assimilation, which amounts to starvation, emaciate and sink into a state of invalidism. Rather curiously in some cases there are periods, sometimes of several weeks' duration, when the patient is comfortable and apparently normal or suffering only slightly with digestive disturbances. This is followed by a relapse lasting several days or weeks, to be followed again by a period of relief and so on. It seems difficult to explain this on the theory of primary mesenteric obstruction. The physical signs are enlargement in the epigastric, the left and often the right hypochondriac regions. With marked distension or with distension and displacement the fullness may extend to the pelvis. There may be resonance or dullness, depending on whether the stomach is distended with gas or fluid. If both are present a splashing sound is elicited. If the contents are fluid fluctuation may be detected. Outside the stomach and duodenal areas the abdomen may be retracted. In those cases, which do not develop a paralytic distension, the physical signs may be negative. The diagnosis should not be a matter of much difficulty, if we keep in mind the possibility of the existence of such a condition. It must be differentiated chiefly from pyloric, duodenal, and high jejunal obstructions, incomplete ileus, internal herniæ and other distensions of the stomach due to

disturbances of its motor mechanism and to displacements. There are other features in differential diagnosis which might be considered. The chief point in the differentiation of gastromesenteric ileus, either in its acute or chronic form, is the relief which should be furnished by requiring the patient to assume certain positions. In ptoses of the stomach, as described by Glenard, it seems probable that resort to position, that is, hip position, would, in the same manner, relieve the duodenal kinks which produce obstruction and dilatation.

A critical analysis of the many cases of stomach disorders, which are now considered to result from hyperchlorhydria and motor insufficiency, and those whose origin is still in doubt, may show that a fair proportion is due to incomplete obstruction by the root of the mesentery.

To illustrate: There is a condition referred to as periodic vomiting, described by von Leyden, which is characterized by attacks of vomiting coming on at intervals, varying from two weeks to several months, occurring suddenly, lasting from a few hours to two weeks and ending abruptly. These attacks come on with unusual regularity. There is nausea and vomiting of mucus and bile, gastric pain, and headache. Nothing is retained and the patient becomes very feeble. The examination of the stomach contents shows nothing.

Take the cyclic vomiting of children: These attacks come on suddenly in health and are quite similar to those just described. Prodromal symptoms are usually present, headache, lassitude, loss of appetite, and coated tongue. A slight elevation of temperature is frequently noticed. The abdomen is described as flat and pain is not usually present. Constipation is common and the stools are often white. Thirst is a distressing symptom. The vomitus contains frothy mucus and serum and sometimes blood. According to common description bile is not found. These attacks have been variously explained as due to a neurosis, faulty digestion, and toxæmia.

Nothing is positively known. Diacetic acid and acetones have been found in the urine, and their presence has been offered as an explanation; but we know these substances are found where there is prolonged starvation and they may be there as a result rather than a cause. It is said that a large dose of bicarbonate of soda, by neutralizing the hydrochloric acid, will sometimes terminate an attack; but Cannon thinks, in cases of hyperchlorhydria, the pain may not be relieved so much by neutralizing the acid as by the fact that neutralizing the acid at the same time closes the pylorus. I am not prepared to say that these symptoms are explainable on the theory of mesenteric obstruction; but I believe investigations along these lines will develop interesting results.

The prognosis in the acute condition is apparently bad, if one can judge from Laffer's statistics, where in 217 cases, 135 deaths occurred. We must remember that many of these deaths took place when the knowledge of the disease and its treatment was imperfect and that from now on the great majority may be saved. In the chronic type without treatment the patient may die from slow starvation or suffer along indefinitely with symptoms which are ordinarily attributed to indigestion, the severity of the symptoms depending on the degree and the persistence of the obstruction.

In the acute form the treatment consists in: (1) the entire withdrawal of all food and fluids, (2) frequent washing out of the stomach and (3) resorting to a position which will permit the small intestines to slip out of the pelvis. The positions recommended are: (1) the knee chest, (2) the prone, resting on the abdomen and probably the best of all, (3) the elevated hip with the patient turned on the right side. Albrecht [1] is very enthusiastic about the prone position. He says the vomiting almost immediately ceases, gas passes, the bowels move and the patient shows a marked improvement. The explanation of the relief afforded is simple. The mesenteric ligament relaxes and allows the gases and fluids to pass the point of obstruction and the position favors their movement along the small intestines. Operative procedures have been recommended for the acute form by Mayo Robson, Byron Robinson, and others. The two mentioned advise gastroenterostomy. Robinson also thought the division of the duodenum to the right of the constricting vessels and its anastomosis with the

[1] Monatschr. f. Geburt. u. Gyn., xxvi, p. 645.

jejunum, anterior to the ligament, could be performed; but he writes, "Perhaps it would be better to perform a gastroenterostomy."

What may we expect from treatment in chronic cases? In the acute form once obtaining relief usually means a permanent cure. In the chronic relief may be obtained by vomiting the food ingested; but the continuation of the process favors starvation. Washing out the stomach is not feasible for the same reason. Presumably posture might be serviceable. Having the patient assume such a position as would relax the traction on the mesenteric ligament should relieve the symptoms for the time; and I believe posture, too, would be of benefit in some of those cases of gastric ptoses where angulation takes place in the duodenum. Leaning forward, as one would do in bending over a chair, would increase the angle between the spine and the mesentery and modify the amount of pressure. This has been referred to by Codman. The treatment of an aggravated case is surgical. Robinson's case in 1895 was cured by a gastroenterostomy. Bloodgood[1] reported a chronic case, in which he had intended to perform a gastroenterostomy; but the patient died before he had a chance to carry out his plans. Commenting on the case afterwards, he suggested a duodenojejunostomy. It was about this time a patient came under my care, whose history I will give in detail, and I carried out the same treatment as had been suggested by Bloodgood. As far as I can determine it was the first time such an operation has been deliberately carried out, and the success was very gratifying. It possesses a distinct advantage over a gastroenterostomy; for with it there is only a slight deviation in the course of the ingested foods and fluids and there is no danger of establishing a vicious circle. Bile and pancreatic juice do not regurgitate into the stomach.

L. F. Barker,[2] in the discussion of Finney's paper on gastromesenteric ileus, suggested, on account of the failure of gastroenterostomy, the possibility of anastomosing the duodenum with the closest available portion of the jejunum. As Barker's suggestion antedates the publication of Bloodgood's paper, I am inclined to believe he may have been the first to suggest the possible value of the operation.

[1] Annals of Surg., 1907.

[2] Johns Hopkins Bull., January, 1906.

Author's first case. Chronic gastromesenteric ileus. Operation, duodenojejunostomy. Result, cured.

Mrs. F. W., aged 36 years, a woman of spare physique. The family history has no bearing. She had measles as a child and whooping cough in 1904. Menstruation began at eighteen. She has had two children, both living and well. The last conception about twelve years ago resulted in a miscarriage. Infection followed and a pelvic abscess formed. Vaginal puncture was done at the Providence Hospital. For five days following the operation there was at frequent intervals vomiting of dark green fluid. Her life was despaired of. Something, she does not remember what, brought about a change and she recovered; but her recovery inaugurated a complex of symptoms which had not existed prior to that time, and which continued up to the time of the final operation. There was a marked distension of the stomach, pain generally severe located in the stomach and extending to the lateral portions of the abdomen, nausea, and vomiting. The vomiting was frequent but not invariably present. These attacks always followed the taking of food. No matter how digestible the latter it was always present; but small quantities of broth gave the least discomfort. Milk had a bad effect. She was obstinately constipated. The distension occurred with remarkable rapidity, almost immediately after the taking of food, was limited to the stomach region and was always present, varying only in the amount of tension. An attack would often last several hours and could only be relieved by drinking hot water and vomiting. The vomitus was always green and bitter. Occasionally she had vertical headaches and severe pains in the shoulders and arms, the latter suggesting gastric tetany. These pains she attributed to the condition of her stomach.

During the seven years the symptoms persisted she had, as well as she could remember, about twenty attacks, during which the stomach became so distended that she lost consciousness. I saw her in the summer of 1907 with Dr. John Shaw and without recognizing the exact condition, advised an operation. She went to the Garfield Hospital where a duodenojejunostomy was performed on December 16, 1907. At that time the stomach was greatly distended. There was a dome shaped projection, which occupied the epigastric region and extended a couple of inches below the navel. A central incision was made. The stomach was distended with gas and the duodenum, about three inches in diameter throughout its entire length, extended well up under the liver and described a U-shaped curve. The distension extended to the mesenteric ligament. The jejunum, which contained some gas, was soft and compressible. The pylorus would easily admit four fingers. Upon raising the transverse colon the bulging of the duodenum could be seen against the mesocolon. Below, the small intestines were contracted. The con-

stricting cause was unmistakable and I decided upon anastomosing the duodenum and the jejunum in front of the mesenteric ligament. This was made easier on account of the large size of the duodenum. An opening was made from below through the peritoneum, a part of the duodenum drawn through and anastomosed to the jejunum about a foot from its origin. The edges of the peritoneal wound were stitched. After the operation she vomited almost constantly until the following morning, after which there was a gradual improvement and all irritation ceased about five o'clock the same afternoon. For two days she was given salt solution by rectum and after that, water by the mouth. On the third day she was allowed albumen water and broths and these were continued for a few days. After that she ate eggs, toast, tender beef, and other such articles without discomfort. The results of the operation have been most satisfactory. At the present time she is entirely free from gastric distension and pain, can eat any kind of food without discomfort and has gained in weight. She can be considered cured.

Author's second case. Chronic gastromesenteric ileus. Gall-stones. Cholecystostomy.

Mrs. W., aged 37, was seen with Drs. Morgan and Clark in December, 1909. She was married at 19 and had four children. She has always had trouble and does not remember the time when she did not suffer with indigestion and collections of gas after eating. These attacks were not severe or prolonged. About 14 years ago, after the birth of her second child, she had a severe attack of what she called indigestion and with this there was a marked distension of the stomach. As she described it, there was "a pressure pain" as though she were bound in by a band and the stomach would swell up "like a ball." She was never nauseated with these first attacks; but always had some pain, which she could often relieve by taking hot soda water and eructating. A physician at that time told her that she had cramp colic. The trouble would usually follow eating; but she cannot remember any especial food which caused it. She had been gradually getting worse; but long periods, sometimes several months, would elapse between attacks. In December, 1906, she had a severe attack, accompanied with intense pain in the stomach, lasting several hours. Since then the attacks have been getting worse and more frequent. In 1908 the acute attacks averaged at least two a week and with the exception of one month, when she was partially relieved, continued until December, 1908, when she had an illness lasting three weeks. For fourteen days she vomited almost constantly a dark green fluid, which she described as intensely acid. She had sharp, shooting, twisting pains, which seemed to develop in the back and extend to both shoulders. She never had pains like these before. After this she improved until March, 1909, when she had an acute attack, lasting two or three hours. From that time until October, 1909, she was free from severe symptoms; from October to January she had attacks frequently and during the four or five weeks before the operation she had constant, rather severe pains nearly all the time. When the attack was severe she would have bad headache. Food distressed her and caused the stomach to swell. On January 5th I operated and removed a gall-stone. At the time I noticed the unusual size of the stomach and duodenum. There was some dilatation of the pylorus. I remarked at the time that it indicated a chronic gastromesenteric ileus. Nothing was done to relieve it, partly because her condition was bad, and partly because I wanted to determine the effect of removing the gall-stone. After recovery from the anæsthesia she began vomiting small quantities of bile stained fluid at frequent intervals, until the second day, when her stomach was washed out by Dr. Clark. I had ordered elevation of the foot of the bed prior to the washing, but through some misunderstanding it was not attended to. Late that evening I called up the hospital and learned that she had vomited over a quart of dark green, sour fluid. Impressed with the feeling that she had an acute form of ileus, I asked if the foot of the bed had been raised as ordered and found it had not been done. The order was then carried out and with the change of position the vomiting and pain promptly ceased. During the time she was in the hospital, about four weeks, the gastric symptoms were in abeyance. Since going home she has had three or four attacks, lasting about two weeks and recurring at intervals of two weeks. In the interval she had no trouble. During the period of discomfort she had after each meal a sudden distension, which came on immediately, lasted for one or two hours and necessitated loosening of the clothing. She has no nausea or vomiting. I saw her on the first of April, 1910, and wishing to determine the size of the stomach in full distension, gave her some tartaric acid and bicarbonate of soda. Upon inflation the organ extended to a point between one and two inches below the navel and filled out the whole epigastric region. Desiring to try the effect of posture with her I requested her to take the knee-chest position for ten or fifteen minutes the next time she had an attack and she reported positive relief from the distension at the end of the experiment. With this patient we have a history which suggests chronic ileus. We find at the operation on the gall-bladder, which according to Laffer's statistics predisposes above all others to the formation of gastromesenteric ileus, a typical dilatation of the stomach and duodenum, this dilatation terminating at the mesenteric ligament; and after the operation the inauguration of a severe attack, which was rapidly terminated by placing the patient in the elevated right hip position and a few weeks later recurrence of mild obstructive symptoms, which were relieved by the knee-chest position. The gall-stone itself may have had no direct etiological relation, as the symptoms which we are considering probably long antedated its formation; but it was a disagreeable complication, which contributed to the diagnostic confusion. The operation was performed with the idea that the trouble was due to gall-stones or duodenal ulcer. One piece of evidence seemed to suggest ulcer — the swallowing of Einhorn's capsule showed upon removal a distinct blood stain on the string. In considering the relation of gall-

stones Kelling states: "There is a certain percentage of chronic ileus in patients who have gall-stone attacks." It may be that in our own case the gall-stone, while being responsible for a special set of symptoms, intensified those of the ileus.

Robinson reports his case as follows: In 1895 Drs. Furth and Henry of Ohio, brought me a case, who had scarcely kept anything on her stomach for eighteen or twenty months or more. She was emaciated and I could detect only a distended or dilated stomach. The gastroptosis is easily detected; for after the stomach is washed out, it is pumped full of air and this method easily demonstrates its outline. I thought this patient had a stricture of the pylorus and possibly a carcinoma; but she did not lose flesh or pale sufficiently for malignancy. On opening the abdomen all we found was an enormous gastroduodenal dilatation, which extended to the pelvic brim. Finding nothing palpably pathologic in the pylorus, I performed a gastrojejunostomy with my segmented rubber plates. She made a good recovery and wrote me four years after the operation that she was perfectly well.

Bloodgood's case was reported in the Annals of Surgery, November, 1907, and his comments are interesting and important. If he had operated I feel sure he would have cured his patient. The history is as follows: The patient was a white, married woman, 42 years of age. Two years before she had mumps and during her convalescence she suffered from abdominal pain and nausea and this persisted intermittently up to the time of her death. During the last year she had five acute attacks, which consisted of pain in the region of the stomach, nausea, and vomiting. They lasted about three days and were relieved by calomel. In the intervals she suffered with indigestion and eructations. She was thin and nervous. Abdominal signs were wanting, excepting epigastric resistance and an indistinct mass situated between the navel and the right costal margin. At the exploratory operation a moderate dilatation of the stomach was found. The duodenum was high up under the liver, distended and U-shaped and surrounded the pancreas, which was hard. The two were unusually movable. The duodenum was soft and compressible. The intestines were small and contracted and there was a marked contrast between the size of the jejunum and the neighboring duodenum. As the condition was an unusual one he closed the abdominal wound. He had considered posterior gastroenterostomy; but the operation did not appeal to him very strongly. After operation there seemed to be a slight improvement. He finally decided upon a gastroenterostomy but the patient died suddenly before he had an opportunity to operate, five weeks after the exploratory operation.

Christian[1] reports the following· Man, aged 70, admitted December, 1903, to the hospital, complaining of pains in the stomach after eating, occasional vomiting and constipation. At this time nutrition was good; abdomen flaccid, not tender. Pressure on the epigastrium caused gaseous eructations. He washed out the stomach and the patient improved, gained ten pounds in one month. He remained well for five months, when the symptoms returned. These remissions and recurrences continued up to the time of the operation in April. In March, 1905, he was readmitted, a careful physical examination was made and his stomach washed out. A probable diagnosis of hour-glass stomach or dilated stomach and duodenum with pyloric relaxation was made. In April gastroenterostomy was performed. The stomach was enormously dilated and there was not pyloric obstruction. The patient died the next evening.

Robinson reports two other cases. The first was an autopsy in which he found an extensive gastroduodenal distension with marked distal dislocation of the stomach. The woman vomited for a couple of years before her death, which appeared to be from marasmus. Death was undoubtedly the result of malassimilation, due to disturbance in her system caused by extensive gastroduodenal dilatation.

In the second case there is no positive information about the duration of the illness; but it was unquestionably chronic. A man, 45 years of age, had been in bed five months with hip-joint disease. He had some lordosis. There was great abdominal distension and the vomiting was continuous. Thinking there was obstruction he operated and finding an enormously dilated stomach, he closed the abdomen. The patient subsequently died and at the autopsy he found a typical gastromesenteric ileus. He believed the prolonged confinement in bed made the progress of the dilatation rapid in its course.

Peebles[2] in 1840, two years before Rokitansky recognized the existence of gastromesenteric ileus, gave a very interesting description of some stomach cases which he considered most unusual, and out of the number six are strongly suggestive of chronic gastromesenteric ileus.

The following case of Valentine's reported by him is very suggestive. A boy, aged 20, fell from a tree and sustained a severe contusion of the back and loins. In a few days he was unable to digest or retain his food, which, both solid and fluid, was ejected, so that in a short time he was confined to his bed with exhaustion. About two months after the fall he had an attack of malaria after which the symptoms became much worse. The stomach became greatly distended and there was constant vomiting of blackish fluid. He lived all together four months. At the autopsy the stomach was found to contain 22 pints of inky fluid. This case is, to my mind, one of gastromesenteric ileus, which, while of only four months' duration, might be classed as chronic.

Another case reported by Peebles is that of a woman, aged 65, who had difficult digestion and alternatively a voracious appetite and a complete anorexia, acid eructations, nausea and vomiting, and epigastric pain. A year later she entered the hospital reduced to the last degree. The stomach was greatly dilated and she had habitual pain. She vomited large quantities of brownish fluid and gas. After the vomiting the swelling always subsided. She died after 15 days in the hospital. At the autopsy the greatly distended stomach was found

[1] Bost. Med. and Surg. Jour., clvi, 609, 1907.

[2] Edin. Med. Jour., 1840.

to descend vertically to the pubis and then ascend abruptly to the epigastric region. While there was some ulceration about three inches from the pylorus there was no obstruction. In drawing conclusions here it seems reasonable to infer that she was a victim of chronic gastromesenteric ileus, which at the time of entering the hospital had become acute and was the cause of death.

The other four cases referred to are not sufficiently well described to admit of positive classification.

Weill[1] presents a case where there was a remarkable regularity about the duration of the attacks and the intermissions. A woman, aged 43, during four years was subjected to two orders of symptoms. For 15 days or less she had continuous headaches. For the following 15 days she had, four or five times a week, vomiting immediately following eating; and at another time remote from the meal a nauseous vomiting of whitish foam. Then the series recommenced. During these four years the digestion remained good and the patient improved in spite of suffering and insomnia. After this long period just described was a shorter one of a few weeks, where there was a bilious vomiting and absolute intolerance of the stomach, headache, and insomnia. There was also anæmia and loss of weight. He thought at first there might have been an abnormal communication between the stomach and the bile passages; but after applying a tight abdominal bandage the patient was relieved of her symptoms and he concluded the trouble was mechanical and caused by the dragging of the stomach on the first part of the duodenum. The relief furnished by the abdominal binder gives support to the views expressed and it is probably, as Weill suggests, prolapse of the stomach.

In gastromesenteric ileus there is always obstruction below the opening of the common bile duct and in gastric ptoses it may be present. Ptosis and ileus may be present simultaneously and cause diagnostic difficulties.

Finney[2] cites the following case: A woman, aged 46, was admitted to the hospital June, 1904, with symptoms of dyspepsia, poor appetite, and eructations of gas. Three years before she had a severe attack of gastritis, during which she vomited a great deal and remained in bed three months. In April, 1904, after some operation on the uterus, she was unable to retain anything. There were frequent fluid regurgitations, pain and distress in the left side, and progressive emaciation. Eleven or twelve weeks after the first operation Finney operated and found a whitish scar-like thickening on the anterior wall of the pylorus; but there was no obstruction. The duodenum was dilated and high up under the liver and under the mistaken notion that the thickening of the pylorus was responsible for the trouble he did a pyloroplasty with the result that the patient died six days later with the symptoms unrelieved.

Scott[3] describes what seems to be a pretty clear case. In giving the report he expresses the hope that it may give aid in throwing light upon other equally obscure conditions. A woman of slender physique, mother of three children. During her college course harsh criticism at meal time would arrest digestion, cause gastric discomfort, and sick headache. In 1902, the interval of time since she left school not being specified, she began with an involuntary and painless vomiting or regurgitation of mouthfuls of acid fluid and bile every morning. The pressure in the stomach caused restlessness. A recumbent position promoted the regurgitation of bile and an upright tended to relieve it. Seasons of starvation lasting two days became common. Toward the end of this time the bile began to regurgitate in mouthfuls, after which the ejected fluid became clear. Two or three hours after the vomiting ceased she would eat with safety and relish and food was not delayed in the stomach. These periods continued without change, gastric lavage did no good, and it was finally decided to operate October, 1899. The stomach was dilated, but not displaced and the pylorus was normal. There was no inflammation and nothing apparently present to explain the condition. The pylorus was closed by ligature and an anterior gastroenterostomy was done. On the third day following the operation a washbowlful of bile was vomited and in a short time she made an uneventful recovery with complete disappearance of the dilatation and the gastric crises. He comments on the vomiting of bile and asks, "Was it the result of some stenosis of the alimentary canal below the common duct, or tumor or kinking of the intestines?" The frequent and complete subsidence of symptoms he thinks makes the hypothesis unlikely.

To summarize. We have reports of eleven cases, all subjected to operation or "post-mortem" examination. Seven are positively identified as gastroduodenal dilatations. The rest are designated as gastric dilatations and cannot be definitely proved on account of insufficient data; but there is little question as to their character. In five there was reported the curious intermission or remission in symptoms, which is so difficult to explain. Seven cases died of the condition. Four of these had submitted to operation. Two of the operations were exploratory and nothing further was done on account of the uncertainty as to the proper procedure. One had a pyloroplasty, which was undertaken through a mistake in diagnosis and of course was of no benefit and the fourth had a gastroenterostomy which was unsuccessful. There were three cures, one of Robinson's treated by gastroenterostomy, one of Scott's by anterior gastroenterostomy and one of mine by duodenojejunostomy. The re-

[1] Lyons Medical, lxv, 1890.
[2] Bost. Med. and Surg. Jour., August 2, 1906.
[3] Amer. Jour. Surg. and Gyn., October, 1904.

maining case, the second reported by me, is still under observation. She has been improved in regard to some of the symptoms since the operation, cholecystectomy; but those of ileus still persist. If the condition becomes worse and the patient consents, a duodenojejunostomy will be suggested. In conclusion we must bear in mind that chronic gastromesenteric ileus is a distinct condition, which must be seriously considered by the physician and the surgeon, that it may be found to be the cause of much ill health and some deaths; that many gastric conditions, which are now differently interpreted, may be found to be dependent on it and that a better knowledge along these lines will result in mitigating the suffering of or bringing relief to many unfortunates.

PARASITIC MYOMATA

With a Report of an Unusual Case

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UTERINE myomata are conveniently classified as interstitial, submucous, and subserous in type, these terms indicating simply the position of the tumors in the walls of the uterus. In the development of the two latter varieties three factors are to be considered.

First, uterine contractions; which may be interpreted as an effort on the part of nature to get rid of the tumors, and which result, therefore, in displacing it either towards the peritoneal surface of the uterus, or in the opposite direction, towards the uterine cavity.

Second, growth along the line of least resistance. A tumor originating close beneath the mucous membrane lining the uterine cavity, on the one hand, or near the peritoneal surface of the uterus, on the other, will obviously enlarge as a rule into a submucous type in the one case, or into a subserous type in the other.

Third, unequal blood supply to different portions of a tumor. That part of the new growth receiving the richest blood supply will, other things being equal, develop most rapidly.

The factors involved, therefore, in determining the type of a given tumor are partly mechanical and partly nutritional.

Rarely the submucous variety of fibroid is gradually expelled from the uterine cavity along the birth canal, becomes completely detached, and results in what may properly be called a spontaneous cure. But the corresponding mode of expulsion and partial or complete detachment of the subserous variety ends quite differently, in that it gives rise to another type of tumor, viz., the so-called parasitic myoma.

By this term we mean simply that the tumor receives its principal blood supply from one or more sources other than the uterus, and in this sense becomes a parasite with reference to its new host.

The chain of events leading to this state of affairs is extremely interesting, but is not difficult of comprehension when considered from a pathological standpoint.

These parasitic myomata may be considered as a failure on the part of nature to get rid of the tumor. They originate in every instance from the subserous type, which first becomes sessile, then pedunculated, and finally almost, if not completely, detached from the uterus. Complete separation is, however, relatively infrequent, as there usually remains a more or less attenuated pedicle attached to the uterus, which marks the point at which the tumor was originally extruded. Kelly and Cullen in their recent excellent and exhaustive treatise on myomata of the uterus report only two cases of complete separation of fibroid tumors from the uterus in a series of 1,674 cases. The case reported below is only the third one met with

at the Johns Hopkins Hospital since its opening in 1889.

Obviously this very interesting process of separation is necessarily associated with marked circulatory disturbances in the tumor. As its expulsion progresses, and its attachment to the uterus becomes more and more circumscribed, there is a proportionate gradual diminution in the blood supply from the uterus, until finally it is shut off altogether. Usually therefore, long before the separation is complete, degenerative changes have begun in the tumor, resulting from insufficient nourishment. Practically the situation then resolves itself into that of a disintegrating foreign body lying within the peritoneal cavity. When so regarded it is easy to understand the remaining events in the life history of one of these tumors.

It immediately enters upon the parasitic phase of its existence, which is made possible through the formation of adhesions to neighboring structures. These adhesions result not only from changes in the tumor itself, but also from changes induced by it in adjacent tissues. It produces a certain type of inflammation by contact with healthy tissues which soon results in the formation of adhesions. These adhesions later become organized, new blood-vessels grow out through them, penetrate the tumor, and convey nourishment to it. The formation of adhesions is in many cases materially promoted by a coexistent or intercurrent pelvic peritonitis of gonorrhœal or other infectious origin.

As one would naturally expect, the omentum is usually one of the first structures to adhere to these tumors, and it is nearly always one of the chief sources of their blood supply.

It would be difficult to find a more beautiful illustration of the adaptability of the omentum than is afforded by these cases. One often sees at operation that after applying itself over a considerable portion of the surface of one of these tumors, the omentum has undergone certain important changes itself which have better fitted it for the new demands put upon it. Thus its fat may gradually disappear until only the delicate layers of peritoneum remain as a supporting framework for the large vessels. The blood-vessels themselves undergo remarkable changes too, in that they become very much enlarged, measuring oftentimes one-half of a centimeter or more in diameter. Plunging directly into the tumor, as they do, it is obvious that they are capable of contributing not only enough nourishment to prevent much degeneration oftentimes, but in addition a sufficient supply to admit of further growth of the tumor. The lymphatic vessels, like the blood-vessels of the omentum, are also very much enlarged, and present a most striking picture when first observed. They stand out conspicuously as large tortuous cords, with extremely delicate translucent walls, ramifying in various directions over the surface of the tumor and in the omentum.

Thus we see that the omentum becomes, in a sense, a relatively highly specialized organ, and after undergoing such modifications as better fit it for carrying on its new function, meets in a highly satisfactory manner the extraordinary demands made upon it by a large parasitic myoma.

It is difficult to convey to the mind of one not already familiar with the subject any adequate idea of the truly remarkable picture sometimes presented on opening the abdomen in cases of large myomata that have become in part parasitic. This characteristic is accurately and graphically shown in many of the superb illustrations to be found in Kelly and Cullen's treatise already referred to. The extensive network of great thin-walled vascular trunks not infrequently encountered may indeed be quite disconcerting even to an experienced operator, and oftentimes the utmost care, with the exercise of considerable surgical judgment, is demanded to effect their safe control as one of the early steps in the removal of the tumor.

Associated with these parasitic myomata one very often meets with ascites, which does not recur after the tumor is removed. It is very probable that this free fluid is the result of mechanical interference with the circulation through the extrinsic blood and lymph vessels of these tumors. It is very easy to understand how a pedunculated fibroid tumor may so shift its position in the peritoneal cavity, or become rotated, that the vessels of an adherent omentum become partially twisted, with resulting congestion and exudate of lymph into the abdominal cavity.

Fig. 1. The parasitic myoma, together with several loops of adherent bowel, and the adherent omentum are shown presenting through a median incision. The omentum is closely applied to the tumor along its upper margin. Along the upper left and lower right quadrants of the tumor are shown dense bands of adhesions to loops of small bowel. On the extreme right can be seen dense adhesions between the tumor and the descending colon. The posterior surface of the tumor rests in a bed of adherent loops of small intestine. Thus it is seen that the tumor has three distinct sources of nourishment. Above, the omentum is retracted to show a large thrombosed vein which is curiously coiled upon itself completely separated from all vascular connections, and is surrounded by delicate adhesions. Note that the parasitic tumor, although fully displayed, is situated so high up in the abdomen that the enlarged fibroid uterus is not visible below.

In this connection it is important to emphasize a very practical point regarding pedunculated myomata to which scarcely enough attention is usually given, and to sound a note of warning. The degree of mobility of an intra-abdominal tumor is usually considered a valuable and important diagnostic point in determining both the nature of the growth and its operability. But in cases of pedunculated fibroid, which are so commonly also parasitic, this test should certainly be made with great caution. In fact when one recalls the picture of the tremendously enlarged, thin-walled, omental vessels spread out over the upper portion of these tumors often presented on opening the abdomen, it is difficult to conceive

Fig. 2. The parasitic tumor has been bisected and its cut surface is here shown. The general contour of the tumor, its definite capsule, the large vessels surrounded by myxomatous tissue situated in a position corresponding roughly to that of the pelvis, the peculiar striated appearance of the islands of myomatous tissue surrounding areas of degeneration, together with the general architecture suggested very strongly a distorted kidney through some developmental anomaly. The resemblance was so striking at operation that microscopic examination was necessary to determine the true nature of the tumor. It was then found that the peculiar appearance was due to focal degenerations.

of a more hazardous undertaking in connection with them than to attempt before operation a determination of the degree of mobility of the tumor. If the patient, while engaged in her daily vocation, has been so fortunate as to escape rupture of one of these large vessels and fatal hæmorrhage from a sudden shifting in position of a pedunculated tumor, this is no guaranty whatever that forcible manipulations during examination will not result more disastrously. How easily the distended omental veins are lacerated after the abdomen is opened, and how alarming the resulting hæmorrhage may become is a familiar experience to abdominal surgeons; a fact which certainly emphasizes the necessity of great caution in testing the mobility of a myoma while making the ordinary exam ations before operation.

As already indicated, the formation of adhesions, which later become vascularized, brings within the reach of these tumors numerous sources of nourishment other than the omentum. Thus the Fallopian tubes, the mesentery of the large or small bowel, the bowel wall itself, the broad ligament, the bladder, and the parietal peritoneum may singly or in various combinations contribute nourishment to a parasitic myoma. As seen in the accompanying illustration, the tumor here represented received nourishment not only from the omentum but also from the mesentery and walls of the large and small intestine.

About two per cent of all myomata undergo malignant transformation, usually sarcomatous in type. Inasmuch as parasitic myomata are so much more apt to degenerate than are myomata which receive a liberal blood supply directly from the uterus, one would suppose *a priori* that malignant changes would also occur relatively more frequently in these tumors. This idea seems to be supported in the statistics of Kelly and Cullen, who found 17 cases of myosarcoma in 1,400 cases of myomata examined. Of these 17 cases, 4 occurred in subperitoneal tumors that had become partly parasitic.

In conclusion I wish to report the following case, which is a most interesting and unusual example of parasitic myoma.

History. M. W. (Gyn. No. 15849), colored, married, aged 38. Admitted to Johns Hopkins Hospital June 25, 1909, complaining of pain and swelling of lower abdomen. Dysuria for more than a year, with some increased frequency of micturition. Menstrual periods more profuse past 3 or 4 years, with slight intermenstrual bleeding. Five children; oldest 25; youngest born 17 years ago, but died in infancy. Labors and puerperia normal. Ten years ago the patient first noticed a small lump in the left iliac fossa, which has steadily grown larger. No discomfort until two weeks ago when she began to have dull aching and dragging pains in the lower abdomen on both sides. One week ago uterine bleeding began, and both pain and bleeding have continued to time of admission to the hospital.

On examination the lower half of the abdomen was irregularly prominent, especially on the right side just below the umbilicus. A firm tumor about the size and shape of a normal kidney could be felt in the umbilical region. One pole seemed definitely larger than the other, however. The surface was irregular. The tumor was definitely attached to the surrounding structures, but movable to a considerable degree. On bimanual examination of the pelvic organs the uterus

was found to be about three times normal size, due to a symmetrical fibroid tumor in its fundus. No connection whatever could be detected between the movable tumor above and the uterine fibroid.

Operation. On June 28th I opened the abdomen through a median incision below the umbilicus. The movable tumor described above at once presented. It exhibited a very remarkable and unusual appearance, being of a dark violaceous color, with a lobulated surface, and corresponding very closely in size, shape, and color to a lobulated kidney lying half buried in loops of small bowel. The anterior surface was adherent at one point to the parietal peritoneum, but was otherwise everywhere smooth and shiny. The consistency was moderately firm throughout. Surrounding the tumor on all sides and adherent to its posterior two-thirds were loops of small bowel. The omentum was densely adherent along its upper border, and lying coiled in it was a large thrombosed vein with its walls intact, but having no connection with patent veins, and easily peeled out from its bed. The tumor was evidently deriving its entire blood supply from the omentum, large and small bowel, but was being insufficiently nourished as shown by the dark color, and obvious degenerative changes. The tumor was situated well up in the umbilical region, and was far removed from the uterus without any signs whatever of recent or old connections with it. The adhesions about the tumor were easily released by blunt dissection, without encountering any large vessels, and the tumor was removed from its bed, leaving a raw, oozing surface over several loops of small bowel which were adherent to each other. These were carefully released, and the raw surfaces covered in. The thickened part of the omentum was also removed.

On account of the fibroid in the fundus, and extensive chronic inflammation of the appendages, a supravaginal hysteromyomectomy with bilateral salpingo-oöphorectomy was done. The abdomen was closed without drainage. The convalescence was entirely uneventful, and the patient was discharged well on the 17th day after operation.

When bisected, the cut surface of the parasitic fibroid resembled even more closely than the outer surface, especially in general architecture, an anomalous kidney, but microscopically it was found to be a degenerating myoma.

The unusual location and the remarkable appearance of both the tumor *in situ* and its cut surface are well shown in the accompanying illustrations.

DEPARTMENT OF TECHNIQUE

THE TREATMENT OF CONGENITAL DISLOCATION OF THE HIP WITHOUT PLASTER OF PARIS

A Simple Retentive Apparatus[1]

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THE disadvantages of plaster of Paris in the treatment of congenital dislocation of the hip are so apparent that they require almost no demonstration. In the first place, there is danger of the hip slipping out during the actual application of the plaster. In the second place, it takes considerable time to apply a plaster dressing, thus prolonging the period of anæsthesia. In the third place, even if the hip is properly put up in plaster, the soft padding which it is necessary to place next to the skin gradually becomes compressed and fixation is in part lost, so that the hip may move and slip out. Fourthly, it is difficult to obtain a good X-ray through the plaster if the plaster is very thick. In the fifth place, pressure sores which are invisible are liable to form. In the sixth place, the dressing becomes badly soiled and the patient's legs and pelvis become covered with filth and coagulated urine, causing itching of the skin which cannot be ameliorated. Finally, and perhaps most important of all, the plaster is liable to get wet and soft or to break by accident, so that in any case it loses its form, therefore no longer holding the hip in position. These seven reasons may be summed up in the statement that the plaster is unhygienic and mechanically unreliable. For these reasons it is extremely desirable to use a substitute for this kind of a dressing, and the aim of this paper is to describe such a substitute.

In contemplating something which would be better for the retention of a reduced hip, there are, generally speaking, three essential things which must be considered — these are efficiency, cheapness, and simplicity. Mechanically, the important consideration is the position of the femur in relation to the pelvis. The point here is that the femur must be maintained in the position of greatest stability. Some men have asserted that another mechanical consideration is the necessity of actually pressing the femur into the joint. This, however, is a far-fetched claim, as no pressure which is important can be applied. In most cases that angle of stability is what is spoken of as right angle abduction. It may be wise (as shown by Bradford) to put up the hip in a position of external rotation besides that of right angle abduction. This is obtained by letting the child rest on a board and letting the lower leg hang over the side of the board. At any rate, the retentive apparatus must have as its first aim this mechanical requirement, namely, the maintenance of the angle desirable in the individual case. So with this mechanical consideration before us and bearing in mind the general considerations spoken of above, we offer the description of the following brace.[2]

The apparatus (Fig. 1) consists of an iron pelvic band running about the pelvis to just beyond the anterior superior spines, to which band is fastened an iron strip running down the external aspect of the thigh, not quite as far as the external condyle. To this there are fastened two bands, one for the lower part and the other for the upper part of the thigh. The stock used is sheet wrought iron, not tempered, and ranges from 18 to 15 gage, depending on the size of the child. The width of the various bands also depends on the size of the child, beginning with $\frac{5}{8}$ of an inch for an infant. The pelvic band may be made a little broader than the others.

The brace is prepared a day or two before the operation. The following measurements are made: First, the thigh is put up in a position of right angle abduction which is usually the desirable angle, then the pelvic and the two thigh measurements are made. These three bands are now prepared, the thigh bands being long enough to

[2] The author wishes to express his appreciation of the valuable help offered by Mr. George Gilford of the Lakeside Hospital Brace Shop, in the construction of this brace.

[1] Dr. G. G. Davis of Philadelphia and others have reported apparatus to be used during the convalescence, after using plaster at the start. However, the present apparatus is prepared before the operation, so that it can be applied immediately after reduction, thus doing away with plaster entirely.

Fig. 1. Brace ready to be covered — double case.

hold the part, going a little more than two-thirds around. The lateral strip is bent to the desired angle, so that the angle comes just below the pelvic band, and allowance is made in its length for the increased length of the thigh after the reduction, taking care however that the lower thigh band comes somewhat above the popliteal space, so as not to cut the hamstring tendons. The various bands are now tried on and their positions marked on the lateral strip, then the pieces are riveted together, two rivets being used at each junction. The position of the lateral strip on the pelvic band is half the vertical height of the pelvic band as the child lies horizontal. The brace is finished as follows (Fig. 2), rather a liberal amount of sheet wadding or light felt is wound about the whole thing, and over this either flannellet or lint is wound and fastened with a few stitches. One end of each band is provided with a webbing strap which can be fastened to the opposite end by means of a buckle, thus enclosing the part. In addition two peroneal straps are fastened to the pelvic band. The brace is put on by springing the bands apart a little, like a Thomas hip brace, and applied next to the skin (Fig. 3). In double cases, both sides are made symmetrical.

If, after reduction, some other angle is desirable than that of right angle abduction, the brace is very easily altered on the spot by bending or twisting, because the metal is untempered. If it is put up in Bradford's position, the brace will hold just as it is. The whole apparatus can be made very quickly and the cost of it in Lakeside Hospital Brace Shop is from two to three dollars, depending on whether it is a single or a double case.

During the convalescence the angle of the femur to the pelvis is gradually changed. This can be done without removing the brace, but it is wiser to remove it and rewind it with fresh wadding and lint at such periods, and when this is done the brace is as good as new, so that there is practically no additional cost after the brace is once applied.

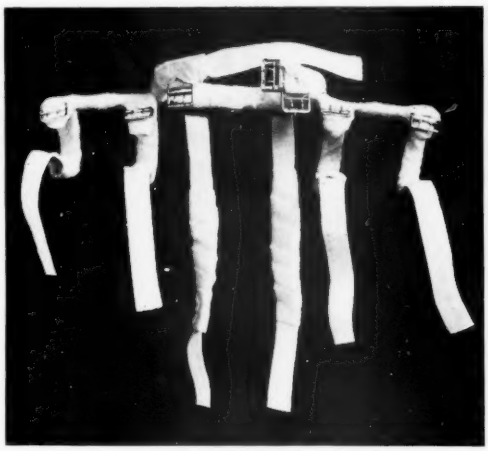

Fig. 2. Same brace finished.

Fig. 3. Same brace applied.

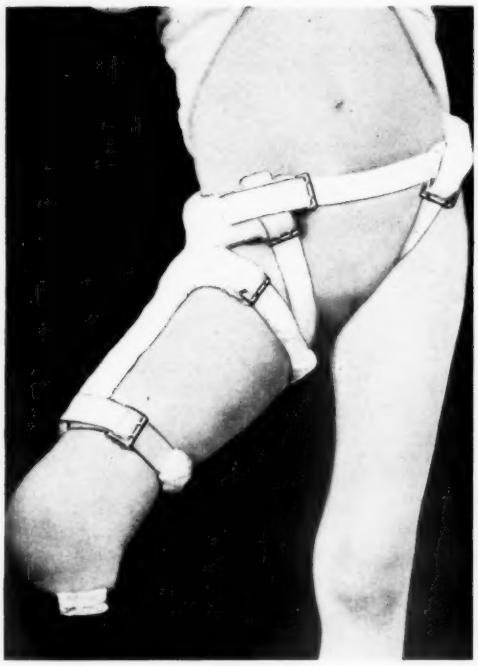

Fig. 4. Patient wearing single brace — front view.

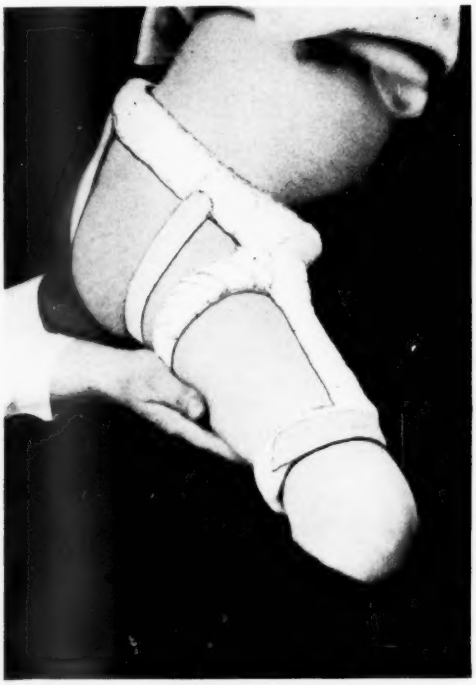

Fig. 5. Patient wearing single brace — side view.

Besides fulfilling the essential requirements of cheapness, simplicity, and efficiency as above apparent, the brace has other important advantages which the plaster of Paris dressing does not offer. For one thing the brace is ready immediately after reduction and is applied in a moment. A good X-ray can therefore be obtained immediately after the reduction to show whether the hip is in place, the child being still under the influence of the anaesthetic. Even without the X-ray one can know pretty well whether the hip is in because even with the brace on, one can palpate the parts and make his measurements. Again, if there is any pressure the brace is very easily adjusted by springing it a little here and there, or by twisting any of the bands. If at any time during convalescence it is desirable to change the angle, this can be done very easily as suggested above. (Figs. 4 and 5 illustrate a patient eight years old, two months after reduction; the angle of the thigh to the pelvis has been gradually changed from a right angle to the present dimension.) This adjustability is of the greatest importance. Again the brace is very light, thus making it very easy for the child to get about with the brace on. In short, the brace has none of the disadvantages which plaster of Paris has, and from both the hygienic and the mechanical point of view answers every reasonable purpose.

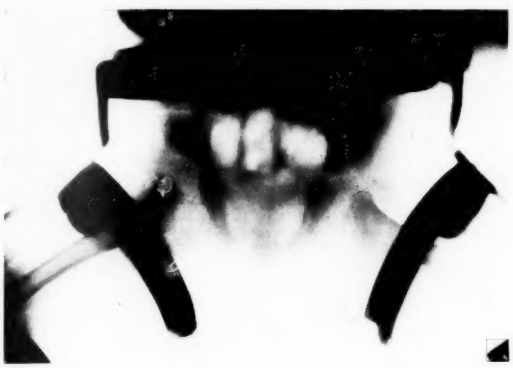

Fig. 6. X-ray of infant mentioned in the text, two months after reduction, still wearing the brace. Note symmetry of joints, suggesting advantage of early reduction, thus made possible by brace.

The advantages can best be appreciated by trying the brace for oneself.

We have nine cases on record [1] which have been held by this method,[2] and although this number is very small, the advantages have been so manifest in these few cases that we feel reasonably certain that we will continue using it in future. One case in special is of considerable significance and is, we believe, the youngest case that has ever been held. This case was that of an infant less than a year old. It was noted to have its hip out of place and contrary to the ordinary indications it was deemed wise to attempt to reduce this hip. This reduction was easily accomplished under ether and a plaster was applied. A few days later the plaster was found soft and not holding and an X-ray showed that the hip was out. Another manipulation was attempted, another plaster was applied but once again the plaster got softened by urine and the hip slipped out. It was at this time that the brace above described was first used. Both hips were put up in order to get greater stability. An X-ray was taken immediately after reduction, another (Fig. 6) two months later, with the brace on, and another four months later, after the apparatus had been discarded. All showed the hip in place.

The deduction from this example is very important, it means that we can reduce congenital dislocated hips even in infancy, whereas before, we had been taught that it was wiser to wait until the child was old enough to keep itself clean and dry. Of course, if we can put these hips in in infancy or early childhood, it means that the prognosis for these cases is better than if we have to treat them at a more advanced age, because it is indisputable that the older the child, the more perverted the bones and soft parts become in their development.

REMARKS ON FLOATING KIDNEY [3]

With Modified Operation for its Relief

By A. HERFF, M. D., San Antonio, Texas

KNOWING it to be a fact that the consensus of opinion is somewhat divided as regards the advisability of performing operations for the relief of floating kidney, I deem it proper to publish an operation that I have been performing for the last four years, with the most gratifying results as regards the relief of most distressing reflex symptoms. The operation has lost its popularity with some surgeons on account of imperfect results obtained, which was largely due to faulty technique. Before going into details as regards the technique of my operation, I shall make a few remarks on floating kidney.

It is not very difficult to differentiate between floating and movable kidney. For clinical and practical purposes a floating kidney is one that has a wide range of movement, apparently within the abdominal cavity; a movable kidney is one that alters its position to a greater extent than normal. A normal kidney always has a slight up and down movement, that is, it is not firmly fixed in position, and when this movement becomes exaggerated, the term movable kidney is well applied. This movement takes place within the fatty capsule and the renal vein and artery are elongated to accommodate it. This condition of the kidneys is often overlooked, especially when the subject is obese, for in such instances, it is almost impossible to detect an abnormal motion. My object is to refer especially to floating kidney, as it is this variety that gives rise to most serious trouble if neglected and allowed to go on. Usually a floating kidney is associated with gastroptosis and enteroptosis, as well as a prolapsed condition of the liver, and upon close examination the entire abdominal viscera seem to be out of their normal position. In subjects that have given birth to children there is generally a prolapsed condition of the uterus. In my opinion the chief causes of floating kidney are a relaxation of the abdominal muscles and a badly developed fatty capsule where there is a deficiency of adipose tissue, producing a lack of tonicity in keeping the kidney in place. Frequently a floating kidney gives rise to little disturbance, and consequently physicians often

[1] For the privilege of working on all but one of these cases, I am indebted to Dr. Dudley P. Allen, chief of surgical service at Lakeside Hospital.

[2] In a tenth case a slough was produced by the brace, and it had to be removed. It was later discovered that the brace was padded accidentally with only one layer of sweet wadding, thus explaining the undue pressure.

[3] Read before the Fourth Annual Meeting of the Medical Association of the Southwest, at San Antonio, Texas, November 9–11, 1909.

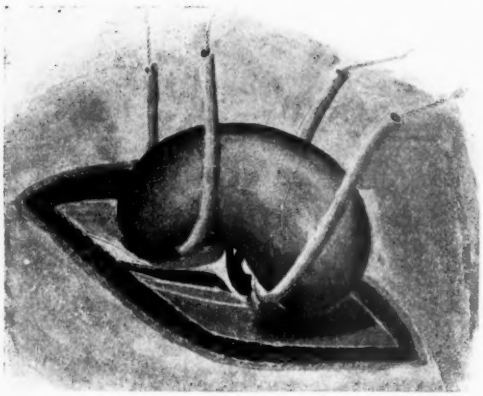

Fig. 1. Showing the kidney delivered.

attach but little importance to its existence. It is my opinion that as soon as a diagnosis is made an operation should be performed for the relief of this condition, as no doubt in time, a floating kidney will give rise to many distressing reflex symptoms and end in serious anatomical as well as physiological changes in the organ itself. The usual symptoms produced by floating kidney are severe disturbances of the digestive organs and excruciating pain in the kidney when the ureter of the affected side becomes twisted or kinked, so as to interfere with the onward flow of the urine to the bladder. The patient is often troubled with severe eructations of gas from the stomach, and in many cases that have come under my observation, the kidney was entirely overlooked and the stomach held responsible for all the distressing symptoms. It is not always an easy matter to detect a floating kidney, as it frequently returns to its place and remains in position a number of days. I have often been obliged to make repeated examinations before I could convince myself of its existence. Patients suffering from this disease have a tendency to become neurasthenic and hysterical; suffer from palpitation of the heart, pain in the ovarian region, so that frequently the ovaries have been removed, when the kidney alone was responsible for the entire suffering. Floating kidney is productive of hydronephrosis and pyonephrosis and also exercises an important factor in the formation of stones, due to the obstructive flow of the urine from the pelvis. I recall two cases which have been under my observation for a number of years, that refused surgical interference, when gradually symptoms of stone developed, and were found when the patients submitted to an operation. Several years ago, I operated upon two female subjects, who were suffering with severe convergent squint. This symptom disappeared completely after the kidney was fixed. It is difficult to explain this unless it was due to a uremic condition. My results in dealing with floating kidneys surgically have been very gratifying and I fail to recall a single case where the patient was not benefited by it. There is no danger attending the operation and in my opinion a floating as well as a movable kidney should always be dealt with surgically. Bandages to keep the organ in place have given me but little satisfaction and in consequence I am not an advocate for this method of treatment. To illustrate the wide range of motion of a floating kidney, I recall a case that occurred in the practice of Dr. F. Herff, Sr. A man was brought in from the country suffering supposedly from a strangulated inguinal hernia. The protruding mass was hard, extremely painful, the abdomen tympanitic, and the patient suffering with severe nausea and vomiting, obstruction of the bowels, and great abdominal distress. A diagnosis of enteroepiplocele was made. Dr. F. Herff, Sr., operated and found the mass to be a floating kidney that had forced its way into and through the inguinal canal, becoming strangulated at the external ring. He found it impracticable to reduce the organ as the kidney had become gangrenous in spots, and consequently deemed it best to remove it. I mention this case as I take it to be unique and illustrates the wide range of movement to which the kidney may be subject Also I cannot remember of ever having seen mentioned a case similar to this in any of the literature at my command. It is unnecessary for me to go over all of the surgical proceedings that have been devised for the relief of floating kidney. The operation performed by means of passing strips of gauze under both poles of the kidney, after the fatty capsule had been removed, and subsequently attaching them to a roll of gauze placed over the kidney, permitting them to remain a number of days in order to produce adhesive inflammation between the exposed kidney and muscles, was favorable in its results. The objection to this method is the liability to infection and the fact that one is dealing with an open wound that requires several weeks to heal, leaving in the end an unsightly scar, with a possibility of the subsequent formation of hernia. The removal of the gauze strips is always a painful proceeding, often requiring the administration of an anæsthetic before it can be done. The results usually are good and a kidney fixed by this method will undoubtedly remain in position, with little danger of recurrence of the difficulty.

The operation of splitting the capsule and sewing it to the muscles with catgut is not satisfactory, since the capsule is not strong enough to keep the kidney in place and frequent recurrences are recorded. I have modified this operation and have operated upon twenty-four patients by my method without a single failure or a return of the affection. The technique of the modified operation is as follows. The usual incision, about six inches in length, is made, extending from the lower margin of the twelfth rib, along the outer edge of the sacrolumbalis group of muscles, downward and forward towards the median line. (See Fig. 1.) If the patient is fleshy, the incision may be extended to give sufficient room. The kidney is exposed in the usual manner, the fatty capsule separated from the organ, and the kidney delivered. It is best to separate the fatty capsule as completely as possible before an attempt at delivering the kidney is made, as it simplifies this part of the operation very materially. It is unnecessary to remove the fatty capsule in all cases. Should this be well developed, however, it may be done to prevent its becoming interposed between surfaces that are to be made to adhere. The true fibrous capsule is then carefully incised upon a groove director and separated from the cortical substance from pole to pole, to the extent of an inch and a quarter on either side of denuded capsule and temporarily fastened with hæmostatic forceps. Before reducing the kidney I pass two rubber tubes through which silk cords have been drawn, under each pole of the kidney, traversing the perirenal fascia and fatty capsule that has not been detached completely at this point, in order to safeguard against a possible slipping of tubes from under the poles. The kidney is then reduced and placed in position. (See Fig. 2.) Two punctures are made on either side of the incision, traversing skin fascia and muscle which correspond to the position of the tubes under the poles and are brought out through the aperture on both sides. The catgut sutures in capsules are rethreaded, passed through muscle and fascia and tied. These serve simply to keep apart the margins of the capsules in order to expose the denuded cortical portion of the kidney to muscle and fascia and insure adhesive inflammation. It is not a good idea to depend upon the capsule of kidney to hold the organ in place, as this structure is entirely too weak to resist the respiratory movements and the impact that is produced by the nausea and vomiting that frequently complicates the administration of an anæsthetic. A few layers of catgut sutures unite the different layers of fascia and muscles that were divided in exposing the kidney. The skin incision is then closed with a continuous horsehair suture. The suspending rubber tubes containing silk cord are slit open to the level of the surface of the skin and the opposing ends of the cord are loosely tied over a small roll of sterilized gauze, which completes the operation. (See Fig. 3.) I have employed this modified method for four years in twenty-four cases, with perfect results, and have as yet to record a failure or a return of the disease. The advantages that I claim for this operation are:

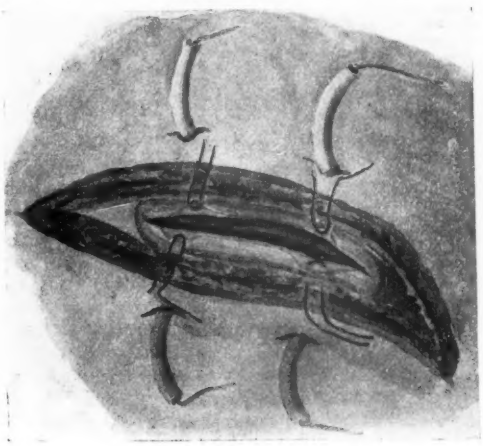

Fig. 2. Kidney replaced with suspension tubes in position.

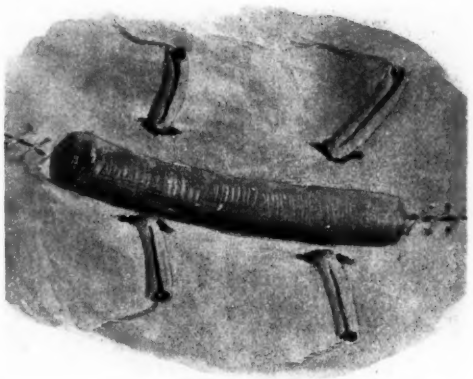

Fig. 3. Wound closed and roll of gauze placed under suspension tubes.

1. The kidney is firmly fixed in position for ten days, when I remove the supporting tubes, which gives the freshened opposing surfaces of kidney and muscle ample time to form firm adhesions.

2. I do not depend upon the capsule to keep the kidney in place, but rely entirely upon the suspending tubes.

3. I deal with a closed wound and usually have union by first intention after ten days.

4. The patient feels comfortable and is able to move from side to side, without the slightest pain.

5. I have no scar resulting as is always the case when the gauze strip method is employed.

6. It is absolutely painless to remove the tube and the patient is often not aware that this has been done, until his attention is drawn to it. I slit open the rubber tubes to the surface of the skin in order to avoid traction upon the rubber tissue for fear that its elasticity may cause it to cut into the kidney substance. The rubber tubes are used simply as a cofferdam to prevent adhesions of the silk cord to the soft parts. I consider this method of operating a good one and if some of the gentlemen here feel disposed to try it I am convinced it will meet with their approval.

THE TECHNIQUE OF RESECTION FOR PROLAPSE OF THE RECTUM

By JOHN G. SHELDON, M. D., Kansas City, Missouri

IN this paper, the varieties of prolapse and procidentia, are, for the sake of brevity, grouped without distinction, under one heading — prolapse of the rectum.

Since 1882, when Aufret (1) did the first resection for prolapse of the rectum, this operation has been considered by many to be the suitable treatment for certain cases of rectal prolapse. The technique, described by Mikulicz (2, 3, 4) who used the method of Aufret, is preferred by many operators, although not a few have discarded it for other procedures, or have adopted one of its many modications. The operation of Mikulicz consists, of first cutting carefully through the outer intestinal tube and exploring the peritoneal pouch to determine the presence of herniated intestines.

The peritoneal surfaces of the outer and inner tubes of the prolapse are united by the Lembert method — the suturing following the cutting of the outer tube. When the outer intestinal tube has been completely severed and the peritoneal surfaces sutured the inner tube of the prolapse is divided and the remaining layers of the upper and lower segments are united. Treves (5) completes the resections before any sutures are introduced. He uses forceps to control the bleeding. Roye and Walken suture the outer to the inner tube before the peritoneal pouch is explored, securing more perfect hæmostasis at the risk of injuring the small intestines. Nelaton, Trelat, Segond, and other French surgeons divide the prolapse into an upper and lower flap; applying forceps above and below. The division and suturing of these flaps is done distal to a clamp which is placed transversely across the flap to prevent bleeding.

Cunningham (6) divides the outer tube completely without providing for hæmostasis, then applies the clamp transversely at the base of the inner tube and nearly completely finishes the suturing before the clamps are removed. The various methods mentioned in the foregoing and the numerous others, or modifications which will not be referred to, suggest that none of them is entirely satisfactory in all cases of excision of the rectum for prolapse.

The operation of resection for prolapse should be formulated so that herniated intestines will not be injured, hæmorrhage avoided, and at the same time provide for a restoration of the parts so that they can functionate normally. All of these things should be accomplished quickly for the element of time required to do this operation is an important one in securing results.

It is important in doing every resection for rectal prolapse that the parts be so placed as to give them the best opportunity to functionate normally. In all cases of marked and long standing prolapse there exists a decided disproportion between the circumferences of the outer and inner intestinal tubes. The lower or anal segment will often be three or four times larger than the upper segment. The smaller tube should be united to the larger in such a manner, that when the operation is completed the rectum will be cone-shaped — the anal orifice representing the base of the funnel. This can only be done by equally distributing the excess of tissue in the anal segment between the sutures, as two unequal flaps are approximated in amputations of the extremities. If upper and lower segments are approximated evenly for a part of the circumference, as is likely to be done in the Mikulicz operation, there will remain a very large

part of the lower segment to be united to a very small part of the upper. This has led operators to supplement excision with operations on the sphincter and lower segment. Duret (8) removes part of the excess anal tissue including the sphincter. Robson (9) makes a curved incision parallel to the anal margin and to one side of it, and sutures it in the opposite direction — so that the line of suture radiates from the anus. I believe that all of these supplemental or auxiliary operations are unnecessary if the approximation of the segments is properly done — the disproportion between the size of the tubes kept in mind. Such a mistake is less likely to be made in resecting according to the method of Treves for the unequal suturing is not obscured in this method by clamps or undivided tissue. The dilated anus and much stretched and apparently useless sphincter will become practically normal after the operation and functionate properly if the orifice has not been distorted by improper suturing, or the rectal lumen angulated at the point of anastomosis.

The operation that I have found to be most satisfactory in resecting rectal prolapse, is begun the same as the operations of Mikulicz or Treves. The peritoneal pouch is first opened and explored to avoid herniated intestines. Then with a finger introduced into the rectum as a guide, a circular row of mattress sutures of number two chromoform catgut is placed from one to two centimeters from the cutaneous margin of the anus, uniting the inner and outer tubes of the prolapse. These sutures are placed about one centimeter apart and contiguous sutures are not introduced successively. One is placed above, another below; then one to the left, and the fourth to the right of the anal quadrant. The remaining sutures are placed between the four that have been evenly distributed around the circumference of the prolapse. This is advised so that there will be an equal distribution between the sutures of the excess of tissue of the lower segment. I consider this an important part of the operation.

After the mattress sutures have been inserted and tied, the prolapse is cut off; which can be done with practically no bleeding. A continuous catgut suture is used to approximate the mucosa of the two segments, which completes the operation. This operation can be done quickly, and there is practically no chance for loss of blood. A possible objection to the mattress sutures is that they would invert the line of union into the lumen of the rectum.

This is not apparent after the operation is completed, and does not conduce to stricture. In fact, I believe that stricture need not be feared if an accurate approximation of the mucosa is obtained. The advantage of these mattress sutures is not alone in the prevention of hæmorrhage. They control the parts admirably, and permit of the resection and union to be made at the desired point.

When the mattress sutures are used, faulty anæsthesia and movements of the patient cannot draw the upper segments of the bowel away from the operator. These sutures also relieve the approximation sutures from all tension so that they do not cut their way through the tissue or produce anæmia of the wound margins.

I have done resection for prolapse of the rectum five times. The patients were all over forty-five years of age; four women and one man. The prolapse existed from ten to twenty-five years. In three cases all of the coats of the rectum were prolapsed; in the other two the peritoneum did not form a part of the protruding tissues.

CASE 1. The first operation was done in 1902. The technique of Mikulicz was followed. Two mistakes were made: First, the incision was made too close to the skin, second, the suturing was done without regard for the differences in size for the outer and inner tubes of the prolapse. The result was that, as the operation neared completion, there was an excess of tissue at one side of the anus to be disposed of. This was resected — removing a triangular shaped piece of tissue including part of the sphincter. The immediate result was "good"; the ultimate result not so satisfactory. The mucosa protruded from the anus at two points at which ulceration occurred. The patient has been constipated and considerable effort is required to evacuate the bowels. There is no stricture. The patient is, at this time, in good health, but the rectum is not entirely satisfactory.

CASE 2. In this case the peritoneum was not herniated. The technique of Treves was followed (prolapse cut off before sutures are introduced). The incision was made three-fourths of an inch beyond the cutaneous margin of the anus. Considerable blood was lost during the operation. Care was taken to distribute, equally, the excess of tissue in the lower segment. The result was entirely satisfactory.

CASE 3. This was a case of marked and long standing prolapse of all the intestinal coats occurring in a woman 50 years of age. The operation was done by the mattress method with the preliminary exploration of the peritoneal pouch. When the prolapse was cut off there was marked hæmorrhage posteriorly. The meso-rectum contained large vessels which had not been included in the grasp of the mattress sutures. This necessitated a search for, and ligation of, the bleeding vessels. The immediate and ultimate results were entirely satisfactory.

CASE 4. This was an incomplete case in a man 47 years of age. The mattress suture method was carried out without difficulty and a good result obtained.

CASE 5. This was a case of complete prolapse of long standing in a woman 60 years of age. The mattress suture was used, care being taken to place one of the sutures so as to include in its grasp the meso-rectum. No bleeding followed the cutting off of the prolapse. The result was all that could be desired.

These suggestions might be offered to those who do this operation for the first time:

1. Make the incision in the mucosa not closer than one-half inch to the cutaneous anal margin.

2. Include the meso-rectum in a mattress suture.

3. Distribute the excess of circumference of the lower segment equally between the sutures.

4. No pack or tube should be placed in the rectum; and the perirectal space does not require a drainage. While the drain and pack were formerly an essential part of the operation; they have not only been found to be unnecessary, but often harmful (Mikulicz). Compound tincture of benzoin will seal the suture line and no local after treatment is required.

In preparing these patients for operation it would seem best not to rely entirely on local measures in preparing the surgical field. The work of Hochenegg and others which have been recently summarized by Matas, shows that liquid stools contain many active bacteria. These patients should be given sterilized food, previous to the operation and the preoperative cathartic should be given at least 48 hours before the operation is performed. In my first three cases the preparation of the patient for operation was not given especial consideration.

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A SELF-RETAINING RETRACTOR FOR ABDOMINAL INCISIONS

BY JAMES CLARKE LOGAN, M. D., PITTSBURGH, PENNSYLVANIA
Demonstrator of Anatomy, University of Pittsburgh

TO those who find a self-retaining abdominal retractor a desired substitute for a second assistant, this instrument is submitted as possessing the following advantages over those now in general use.

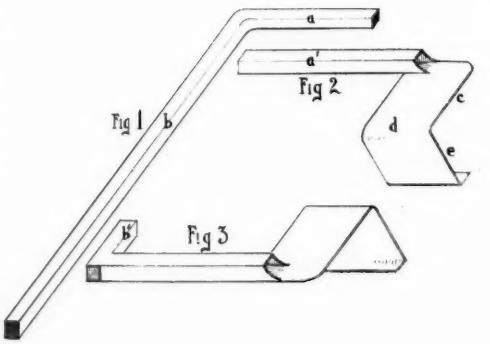
1. It is without ratchet, set screw, or any rough surface which is difficult to keep surgically clean The grip is due to friction and holds best under strain. It requires but little adjustment,—I have had it in position an hour, during which time it was only adjusted three times.

2. The adjustment is easy and the work of but a moment.

3. It is small and compact, easy to transport and not in the way during operation.

4. Several sets of blades may be had to fit any size incision or thickness of abdominal wall.

After the incision, the initial digital exploration and the insertion of gauze pads, the retractor may be inserted and will remain in position, with occasional touch for adjustment, giving as wide retraction as is desired.



Figs. 2 and 3 are regulation flat retractors fixed at 90° on hollow shafts which fit accurately over the solid bar, Fig. 1. Fig. 2a′ fits over Fig. 1a and remains the fixed blade; Fig. 3b′ slides over Fig. 1b (The dimensions, c, d, e, vary in different blades.

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SEPTEMBER, 1910.

A CLINICAL MEETING

It was a brilliant idea that occurred to some one in Boston, Chicago, Philadelphia, Baltimore, or New York, and which was put into execution by a coterie of the leading surgeons of America — that of visiting at stated intervals the clinics of each other, for the purpose of observing, criticising, and learning, and finally for the purpose of co-operating in cultivating a spirit of enthusiasm and investigation — the outcome of which has resulted in the establishment of the Clinical Society.

For five years this society has quietly met several times a year in the principal clinical centers of the United States, and this year its members invaded Great Britain. During this time there seemed to be no lagging of interest, and it is safe to say that its influence for good, both on the clinics visited and the visitors, as well as upon the surgical literature of the United States, exceeds that of many societies of much greater pretensions. It is the spirit of clinical investigation carried to the practical point of "show me."

The idea has been growing for the last two decades. Clinical schools, where the work of a limited number of operators could be observed, have been organized and rather liberally patronized; also it has occurred to a few of the more progressive undergraduate schools to invite their alumni to a week of clinics each year at commencement time. The merited fame of several large surgical clinics, to which physicians were welcomed, has attracted surgical practitioners in greater and greater numbers for several years, until some of these clinics have become veritable surgical meccas.

This tendency to learn by watching the actual work of the masters has become more and more popular, and the demand of the spirit this has engendered is for greater opportunities for clinical observation. If the technical skill of American surgeons, or those of any other community, is especially excellent it is because these surgeons are willing and anxious to learn by observing and being observed while actually at work in the operating room. This sort of training and observing has without doubt unhorsed a few literary and oratorical clinicians, but on the other hand it has brought to their proper perspective the hard-working, painstaking surgeons who make good.

A recognition of the above facts, after duly considering their purport and the tendency of the times, has led the editors of SURGERY, GYNECOLOGY AND OBSTETRICS, in an endeavor to still further amplify the clinical idea, to

invite to a clinical meeting, not a limited number to see the work of a few surgeons, but as far as practicable, every man in the United States and Canada who is particularly interested in surgery, to observe the principal clinics in one of the large medical centers.

The initial test of this experiment will be inaugurated in Chicago, and the invitation is to be extended for the two weeks, November 7 to 19, 1910. The program (see pages 17–19 of advertising section) will consist of operative clinics extending from 8 A. M. to 5 P. M. each day during the two weeks. Headquarters will be established at a central point where cards of admission to all clinics will be issued to visiting surgeons, and where each day will be bulletined the clinics and demonstrations for the following twenty-four hours, thereby giving the visitor an opportunity to select his own program for the day.

Six evenings of the two weeks will be given over to literary programs of surgical subjects conducted by the established societies of Chicago. These societies are preparing programs dealing with the practical live subjects in surgery, and the participants, who will be invited to co-operate with the Chicago surgeons, will be selected from the men in the United States and abroad, who are considered authorities on the particular subjects selected. The societies that will participate are the Chicago Medical (two meetings), the Chicago Surgical, the Chicago Gynecological, the Chicago Neurological and the Chicago Orthopedic Societies.

In working out the details of this undertaking the Editorial Staff must acknowledge the assistance and co-operation of the medical profession of Chicago, and especially the officers of its medical societies and the clinical teachers of its various hospitals and schools.

FRANKLIN H. MARTIN,
Managing Editor.

THE NEWER SURGICAL METHODS IN THE TREATMENT OF SPASTICITY AND ATHETOSIS

The two neurosurgical contributions appearing between the covers of this issue have the distinguished merit of advancing new methods of treatment in a field of endeavor hitherto disappointing and quite barren of results.

It may not be said that defective development of prenatal origin or deformity ensuing from a lesion of the central nervous system has been viewed with complacent indifference by those whose special province it is to understand and alleviate the distressing and disabling end results of agenesis and disease. On the contrary, a truly consummate amount of energy and zeal has been directed at these problems but, curiously enough, the therapeutic attitude has been taken, as Schwab and Allison remark, "without a mutual appreciation of surgical and neurologic points of view." The pediatrician and neurologist have been chiefly absorbed with the problems of pathology and diagnosis of the various forms of diplegia, while the orthopedist and surgeon have had uppermost in mind the mechanical correction of faulty posture, contracture, and resultant gross deformity. The question of the relation of sensori-motor innervation to muscle tone, and the value of the two combined in determining function, have been either undervalued or misunderstood. It is to the credit of Schwab and Allison to have emphasized in an earlier preliminary report[1] and again at this time the mechanism at play in the conduction of irritable nerve impulses, the effect of such impulses on muscles in the form of overaction, and, finally, the possibilities of readjustment between the overacting physiologically stronger spastic muscle group and the uninvolved antagonists following alcoholization of the

[1] "The Surgical Treatment of Athetosis and Spasticities by Muscle Group Isolation." Schwab and Allison, Jour. of Nerv. and Mental Diseases, No. 8, August, 1909.

peripheral nerves. The authors believe their method will find its widest range of application in the field of the spastic paralyses of children. These cases are very numerous and, while showing considerable uniformity in their clinical features, they excel in the element of spasticity which is present in all to a slight or great degree. As a prerequisite to success in treating these cases by this or any other method that blocks out sensory impulses, it should be borne in mind that the spasticity present must be considerably in excess of the paralysis. A spastic child subjected to this method or a spastic adult subjected to posterior root resection will not get much relief if the spasticity is slight and the motor weakness great, whereas the conditions reversed may be counted on as favorable to a good result. When weakness and spasticity coexist, as they are sure to do, the spasticity may so preponderate as to render it next to impossible to adjudge the degree of weakness. Although Schwab and Allison do not specify in what class of cases they expect the best results, it is only fair to hint that the very chronic, badly twisted, scissor-leg, bedridden types that find their permanent abode in our large institutions have little to hope for from the method, whereas the milder, ambulatory cases, showing some cross-leggedness in paraplegic progression, and retaining a good degree of motor power in the extremities, are quite sure to be afforded relief. It is pertinent to add, however, that since the nerve impulses are blocked out in their periphery, an alcohol attack upon the obturator nerves, for instance, to eliminate the adductor spasm prominent in Little's disease, will in no sense suffice to fully correct the position or restore the limbs to general usefulness, to accomplish which it may be found necessary to inject the branches of the sciatic and still other nerves obviously involved by reason of contracture or malposition in the related parts. Only a series of injections well placed into different nerves, and in the end assisted by massage and physiologic exercises, will give promise of success. And in this connection it is well to note the reserve with which the authors propose their method, stating: "The chief object of treatment in all cases of spasticity is to enable the patient to make properly co-ordinated movements with the mechanical disability caused by spasticity rendered as ineffective as possible." No cure for the spasticity *per se* is announced or implied, the sole contention for their method being that spastic impulses are sufficiently reduced to achieve finally a satisfactory degree of co-ordination and function.

As concerns the technique, the neurologic side of it is not so simple. To select the muscle or group of muscles to be isolated, to understand their rôle in the functional deficit, to properly determine the innervation with the aid of electrical reactions — all these factors entering into the problem call for special knowledge, together with exact interpretation, and are not to be left for conjecture by an untrained mind or unskilled hand. The surgical interference, also, calls for special talent in the apt recognition of nerve structure, a precise knowledge of nerve topography, and accuracy in dissection, in short, the refined sort of work so particularly desirable in neural surgery in order to assure a maximum restoration of function by rendering a minimum amount of trauma.

Although it may be claimed for Förster and Tietze that they were the first to perform posterior root resection for the cure of spasticities, the distinction of having been the first to recommend this procedure belongs to William G. Spiller, who, as early as 1905, suggested the propriety of such an operation before the New York Neurological Society. It is a curious thing that no one prior to the date of Spiller's suggestion had commented upon the feasibility

of attacking a motor disability through a sensory mechanism. As Spiller himself observes, the phenomenon of a returned patellar reflex in tabes after an attack of hæmiplegia should have led to an earlier exploitation of the whole question of spasticity. For a comprehensive discussion and review of the premises for which this operation of posterior root resection was proposed, the reader is referred to a recent paper by Spiller.[1] In fact, the aims, scope, and results of the treatment have been so fully presented by Clarke and Taylor,[2] Spiller and Frazier,[3] Förster,[4] Tietze,[5] Gottstein,[6] and Küttner, and, again, so very ably restated in the current paper by Frazier, that one may be pardoned for being content with these citations. Out of the mass of evidence, however, one may glean that posterior root resection, although an operation of gravity, and still in its developmental stage, is of undoubted utility in selected, chiefly adult cases of spasticity and athetosis of the severer grade.

In reading Dr. Frazier's paper, the surgeon will no doubt find much to attract him in the more technical issues pertaining, for instance, to laminectomy, in which he differs from Taylor, who advocates a unilateral opening to the spinal canal, claiming to have a better view and reach of the roots on the same, and even opposite, side of the cord. In this deep and narrow field of operation the recognition of the root or roots to be resected is not easy, although the posterior root may be recognized by its larger size, and more lateral position. What, more than all else, is praise meriting in Dr. Frazier's conclusions is the total absence of propagandism. The conviction is expressed that this operation serves to relieve permanently spasticity, caution is advised in the selection of cases, the indications are clearly stated, the cases adequately reported, the need for after treatment duly emphasized, and the tendency to promote undue enthusiasm as to the final outcome is neutralized by the reflection that "sufficient time has not elapsed in many cases for the best results to be attained."

So long as experience is heaped upon experience, and caution pervades the whole, there is little danger in this formidable kind of work of bringing a new method in the domain of neural surgery into disfavor or disrepute.

D'ORSAY HECHT.

[1] Spiller: Jour. Amer. Med. Sciences, June, 1910, p. 872.
[2] Clarke and Taylor: New York Med. Jour., Jan. 29, 1909, p. 215.
[3] Spiller and Frazier: University of Pennsylvania Medical Bulletin, January, 1910, p. 314.
[4] Foerster: Mitth. a. d. Grenzgeb. der Medicin und Chir., 1909, vol. 20, p. 403.
[5] Tietze: Mitth. a. d. Grenzgeb. der Med. und Chir., 1909, vol. 20, p. 550.
[6] Gottstein: Berliner Klin. Woch., 1909, No. 17.

THE SURGERY OF THE HYPOPHYSIS

The relationship between lesions of the hypophysis and acromegaly is by no means generally conceded, although recent observations tend to substantiate Marie's original suggestion that the disease is dependent upon alterations in hypophyseal secretion. Even among those who are willing to admit that the disease is dependent upon changes in the hypophysis there is a difference of opinion as to whether it is due to hyper-, hypo-, or dyspituitarism. The confusion which exists concerning this subject is due in great part to the lack of uniformity in the description and classification of tumors of the hypophysis which have been associated with acromegaly. In studying tumors of the hypophysis it should be kept in mind that the gland has a complex histology, and that the cellular elements of the anterior lobe when proliferating or undergoing hyperplasia tend to reproduce the structure of a sarcoma.

In many of the earlier cases of acromegaly associated with tumors of the hypophysis the anatomic diagnosis of a sarcoma was made. Benda suggested that most of these were hyperplasias or adenomas and emphasized the

necessity of using stains which differentiate granules in studying tumors of the gland. His view was confirmed by Mendel, who re-examined a number of tumors of the hypophysis associated with acromegaly which had been reported as sarcomas but proved to be adenomas or hyperplasias. This work has removed one obstacle to the establishment of he etiological relationship between growths of the hypophysis and acromegaly, as it demonstrates a uniformity in the hypophyseal changes in this disease.

Recent statistics have shown that at least 83 per cent of the cases of acromegaly are associated with hyperplasias or adenomas (simple or malignant) of the pituitary gland. Adenomas of the hypophysis composed entirely of chromophile cells — supposedly the most actively functioning type of cell — have been observed in cases without acromegaly and adenomas composed of chromophobe cells — supposedly the least active type—have been found in patients suffering with the disease. Examples such as these have been used by some, who believe the hypophyseal changes secondary, against the etiolegical rôle played by the growths in the gland which occur with such uniformity in acromegaly. The analogy which exists between the thyroid and pituitary glands should be considered in this connection. Cysts, adenomas, and even chondromas of the thyroid gland may be associated with hyperthyroidism which subsides when the growth not containing actively functioning cells, or in the case of the chondroma any specific cells at all are removed. The work of Löwenstein has shown that adenomas of the hypophysis unaccompanied by symptoms are common. In the case of the chromophobe adenomas accompanied by acromegaly, the adenoma may have influenced the remainder of the gland to active secretion.

Tumors of the hypophysis may be present without causing acromegaly and conversely acromegaly may exist without a tumor being present. The only tumors which we should expect to be associated with acromegaly are those composed of the specific cells of the anterior lobe. Sarcomas arising from the stroma of the gland, gliomas, tumors of the infundibulum and tumors extending to the hypophysis from neighboring structures, in other words, heteroplastic tumors, are not accompanied by acromegalic symptoms.

The few cases of acromegaly which have been reported in which there were no changes in the hypophysis are open to doubt. In most of these cases a careful histologic examination of the hypophysis has not been made and in those cases in which such an examination has been made with negative results, a search for and examination of the pharyngeal hypophysis — the significance of which has recently been emphasized by Halberfeld — has been neglected.

Most of the recent work supports Tamburini's view that acromegaly is the result of hypersecretion of the pituitary gland. In the early stages of the disease the hypophyseal changes consist of hyperplasia with proliferation of the eosinophile cells. During this period the skeletal changes manifest themselves. During the later stages of the disease the gland may undergo atrophy or malignant degeneration. These changes coincide, according to Tamburini, with the cachectic stage of the disease.

The theory of hypersecretion is supported by the brilliant results obtained by Cushing and Hochenegg following partial hypophysectomy in acromegalic patients.

The other clinical syndrome associated with lesions of the hypophysis is that described by Fröhlich. It is characterized by adiposity, genital atrophies, changes in the secondary sex characteristics, and the development

of the feminine type. This syndrome is frequently associated with tumors which develop about the infundibulum. Although isolated reports of tumors with these topographical relations have appeared in the literature for a number of years, their origin has been but recently correctly interpreted. Erdheim has shown that these growths develop from inclusions of the craniopharyngeal duct. They are the most common tumor about the infundibulum and in about 33 per cent of the cases they are associated with Fröhlich's syndrome. Whether or not Fröhlich's syndrome is due to hypopituitarism, to interference with some specific part of the gland, such as the pars intermedia, or to pressure upon centers situated at the base of the brain, as suggested by Erdheim, is, I believe, an open question. Cushing's recent experimental work seems to indicate that this syndrome is the result of hyposecretion. Madelung's case in which the syndrome developed after a gunshot wound of the base of the skull involving the sella turcica is of interest. Tumors of this group contain none of the specific elements of the anterior lobe and are never accompanied by acromegaly.

The hypophysis plays many important physiological rôles. Extracts of the gland have a very decided effect upon blood pressure when injected intravenously. Oliver and Schäfer in 1895 demonstrated that injections of extracts of the gland caused a rise in blood pressure. It has generally been regarded that the posterior lobe was the part of the gland in which could be found the substances which exerted an influence upon blood pressure. Both a pressor and depressor substance has been isolated from the posterior lobe. The substance has the same effect upon the frog's eye as adrenalin and long continued injections are said to be followed by arterial changes. Extracts of the anterior lobe have usually been regarded as practically inert. Hamburger has shown, however, that saline extracts of the anterior lobe have a marked depressor action. His work can easily be verified. It is open to doubt, however, whether this depressor reaction is specific for the anterior lobe. It probably corresponds to the depressor reaction which can be elicited by the injection of the extracts of a number of different organs.

The hypophysis is intimately associated with a number of the glands of internal secretion. The association seems to be most intimate between it and the thyroid gland, pancreas, testicles, and ovary. Histological similarities between the thyroid gland and the hypophysis suggested that there might be some association physiologically. Changes in the hypophysis in cretinism were noted some time ago. Rogowitch noted compensatory changes following removal of the thyroid gland. Benda noted evidences of atrophy in cases of Graves' disease. In this disease the delicately pointed fingers which have been compared by Revilliod to the fingers of the Madonnas of Raphael and Perugino are in marked contrast to the blunt fingers of acromegaly. Considerable doubt has recently been cast upon the relationship between the hypophysis and thyroid gland by the work of Halliburton who has shown that the hypophysis does not contain iodine. It is difficult to conceive how a gland which does not contain iodine could act vicariously for the thyroid.

Hansemann found glycosuria twelve times in 97 cases of acromegaly and Pierre Marie noted its presence in one-half to one-third of the cases. Whether this glycosuria is the result of hyper- or hyposecretion is still unsettled. Borchardt has caused glycosuria in rabbits by injecting hypophyseal extracts and Cushing has noted temporary glycosuria in some of the animals upon which partial hypophysectomies have been performed.

The intimate relationship between the genital organs and the hypophysis is shown by the frequency with which impotence and amenorrhœa occur in acromegaly and with tumors situated about the infundibulum. It cannot be definitely said whether the adiposity in Fröhlich's syndrome is primarily due to the tumor or whether it is the result of genital atrophies.

It seems to have been definitely established that the anterior lobe of the hypophysis is essential to life, therefore, partial hypophysectomy is the only operation to be considered. Total removal would be most difficult even if planned, because of the deep position of the gland and the difficulties of approach. It seems doubtful whether partial hypophysectomy should be attempted in cases of chronic acromegaly in which there are no eye changes; for these patients may live for a number of years in comparative comfort. In the acute cases, an operation should be attempted even if the eye changes are not marked. The chief indication for operation in tumors involving the hypophysis with and without acromegaly are preservation of eyesight, the loss of which may supervene rapidly without previous choking of the disk, and relief of increased intracranial pressure.

The hypophysis is so situated that there is no ideal approach for surgical interference. The oronasal method recently employed by Halstead and the infranasal route used by Kanavel give good exposure and splendid cosmetic results. DEAN D. LEWIS.

TRANSACTIONS OF SOCIETIES

CHICAGO SURGICAL SOCIETY AND CHICAGO NEUROLOGICAL SOCIETY

A JOINT MEETING OF THESE SOCIETIES WAS HELD MAY 13, 1910, WITH DR. ARTHUR DEAN BEVAN, PRESIDENT OF THE CHICAGO SURGICAL SOCIETY, AND DR. D'ORSAY HECHT, PRESIDENT OF THE CHICAGO NEUROLOGICAL SOCIETY, PRESIDING

The following papers were read and appear in this issue of SURGERY, GYNECOLOGY AND OBSTETRICS:

1. EXPERIENCES WITH MUSCLE GROUP ISOLATION IN THE TREATMENT OF SPASTIC PARALYSES.
By DR. SIDNEY I. SCHWAB and DR. NATHANIEL ALLISON, of St. Louis, Missouri. (See p. 240.)

2. THE TREATMENT OF SPASTICITY AND ATHETOSIS BY RESECTION OF THE POSTERIOR ROOTS.
By DR. CHARLES H. FRAZIER, of Philadelphia, Pennsylvania. (See p. 251.)

DISCUSSION

DR. HUGH T. PATRICK: I have nothing to add to the wonderful array of facts and deductions and suggestions we have received to-night. The subject, as presented by these gentlemen, is not only an exceedingly pregnant one, but it gives us a great deal to think about.

I was particularly interested in Dr. Schwab's statement concerning injections of alcohol for tic. For a great many years I have been trying to find a surgeon who would tell me he could do a laminectomy of the upper four or five cervical vertebræ without any danger whatsoever to the patient, because I should like to have the posterior roots divided on both sides for the relief of spasmodic torticollis. I believe it would be essentially a perfect operation for this very intractable functional disease, but as I have yet failed to find a surgeon who thinks this operation is utterly devoid of danger, and as no person with spasmodic torticollis has cared to submit to a dangerous operation for a non-dangerous malady, I have not had my idea carried into execution. But I would venture timidly to suggest to Dr. Schwab and Dr. Allison that in this disease they dissect out all the cervical nerves on both sides of the neck and inject them all simultaneously, feeling that they would cure cases of spasmodic torticollis for a time, and I hope functionally for good.

DR. ALLEN B. KANAVEL was asked to participate in the discussion. He said: I naturally feel some timidity in making any remarks concerning the papers which have been presented this evening, because I am sure all of us feel that these papers are milestones in the progress of surgery and will give impetus to work of this type. I suppose Dr. Hecht called upon me because through his suggestion I have done some cadaver work in relation to resection of the posterior roots. In this particular work we used the technique suggested by Professor Taylor, in which we did unilateral laminectomy. Upon the cadaver the operation was entirely feasible and we were able to find the roots without difficulty. We tied the roots with strings to be sure we had the roots, and later dissected them out, so that we knew we had them all. There were one or two practical points that came up. At first, we would only grasp a portion of the posterior roots. Several times we would grasp a section of the posterior root and later find that we did not have all the root, but only a portion of it. This, of course, occurred with the lumbar nerves. In that region also we had no difficulty in pulling the nerves over to secure the nerves of exit on the opposite side. Higher up, where the nerves come off and make their exit from the spinal canal and closer to the exit from the cord, we were able to cut the roots and differentiate them more easily.

DR. ARCHIBALD CHURCH: I feel incompetent to discuss the operation that has been proposed. I am reminded in regard to athetosis that some fifteen years ago I had a case in which the right arm was severely affected in a child the subject of cerebral hæmiplegia of infantile origin. The arm was animated to such a degree by athetoid movements that the patient at all times used her left hand to secure and hold in some sort of sub-

jection the right arm, which would riot about in the most peculiar fashion. Dr. Fenger, at my suggestion, uncovered the corresponding portion of the motor zone of the brain and removed the arm area, inducing a flaccid paralysis. I followed the case for a year and a half, and during that time a little voluntary control, especially of the shoulder and elbow, was recovered, the athetosis being completely absent as long as the case was under observation.

In regard to spastic conditions affecting the lower extremities, I recall a case in which Dr. McArthur exposed the obturator nerve on each side in a young man who had marked paraplegia with great spasticity. The resection of both obturators isolated the paralyzed adductor groups, and enabled him to dispense with cushions formerly worn between the thighs, and to wear a urinal with greater comfort and ease. In that case, too, we tried to paralyze several other groups of muscles, particularly the hamstring groups, by tenotomies, with little success. In such a case as that, I look upon the operation, which has been so admirably presented to-night, as very promising.

Dr. Edwin W. Ryerson: It seems to me this question of doing laminectomy for the relief of paraplegia or diplegia is a serious one, the mortality of which at present is rather high. It is also true that by tenotomies in the proper places and tendon transplantation in proper places, a great deal can be done for the paraplegic cases. It is possible by tenotomizing the tendon Achilles and cutting the adductors, and by properly retaining these in the overcorrected position for a sufficient length of time, to accomplish good results. It is not possible to obtain much relief by simply tenotomizing the hamstring tendons. I have done more than fifteen of these operations. All cases in which I tenotomized the hamstrings had rapid recurrences. The hamstring tendons grow together very fast and the condition is reproduced. It is not so with the adductors or with the tendon Achilles. Usually one cutting will suffice, provided the limb is put in plaster of Paris with the foot in an overcorrected position, and it is possible to get good results in these two groups of muscles. When we come to the hamstrings it is not sufficient to tenotomize them. I have three or four children who, in a comparatively short time, have learned to walk, with some spasticity, it is true, but who nevertheless, can walk with little or no assistance.

The cases of athetosis are different. I do not think any tendon transference or tenotomies will do any lasting good in the athetoid cases. Only a week ago I exposed the brachial plexuses of a child, and injected the musculocutaneous and median nerves with eighty-five per cent alcohol. I did not think the athetoid movements were caused by the muscles supplied by the musculospiral nerves, and I did not inject them. The inward movements and flexion of the arm are now passive in this child. The athetoid movements in the extensors of the wrists are troubling her, and I am considering the advisability of cutting down upon the musculospiral and injecting alcohol.

Nerve root resection is attractive, and if it could be said that this operation can be done with a good margin of safety, it would appeal to me strongly. However, I think it is a step in the right direction. It requires much experience, and with the varying results of the different groups of nerves cut, it means that it will require further experimentation. It is difficult for me to understand why the cutting of one set of nerves in one patient and a different set of nerves in another patient will produce the same favorable results in both cases, but it must be so, because it has been shown to be so, and I hope to learn more about it in the future.

Dr. D'Orsay Hecht: I should like to say a few words bearing upon the subject, chiefly because of some personal experience and familiarity with the action and effect of alcohol on peripheral nerve trunks following perineural or intraneural injection. Having treated by the deep injections of alcohol a considerable number of cases of trifacial neuralgia and having seen one result of cessation of twitching in a case of genuine facial spasm so treated by Dr. Patrick, I naturally enough felt a keen interest in the publication of Drs. Schwab and Allison relative to the use of injections of alcohol for the relief of spasticity. If I mistake not, I think I am the first in Chicago to have done an injection after the manner and method set forth by our guests in their preliminary paper on the subject, appearing August, 1909, in the *Journal of Nervous and Mental Diseases*. Waiving details, my first case was one of Little's disease, in a boy, six years of age, under the care of Dr. Jacobs, at the Home for Destitute and Crippled Children. The cross-legged deformity due to adductus spasm was quite marked. I very much regret that photographs were not taken before and after our operative interference. I injected the right obturator nerve high up, before its bifurcation into the superficial and deep branch, with sixty minims of an eighty per cent solution of alcohol, in all respects following closely the technique of Schwab and Allison. I might add that when the nerve came into view I was uncertain as to its being the superficial or deep branch, but dissection higher up toward the pubic ramus cleared up any doubt and I felt reassured upon getting a definite ad-

ductor muscle twitching response when the nerve was pinched between the forceps. I did not carry out the more refined maneuver of using an electrode. Immediately upon injection a flaccid paralysis of the adductors was substituted for the spasticity — further proof that the alcohol had accurately reached the nerve. I purposely refrained from injecting the opposite left obturator, thinking to leave it spastic for comparison. I was curious to know how transitory or permanent the induced paralysis was likely to be. I felt prejudiced that with the resumption of function and power there would come a return of the spasticity, and I am even now in doubt as to this point. To me it seems as if spasticity is the necessary accompaniment in these conditions of motion.

In this connection it is interesting to observe the unexplainable phenomenon consequent upon nerve injections elsewhere, as, for instance, in genuine facial spasm. Here the seventh nerve is at once paralyzed after contact with alcohol, but the paralysis disappears in due time, and yet the spasm apparently remains away — at least, this was true of the case I saw with Dr. Patrick several months after injection. Perhaps Dr. Patrick will tell us the more ultimate outcome.

DR. PATRICK: The spasm has returned in that case. The case has been reinjected and is again all right.

DR. HECHT (resuming): Then I repeat: There was no return of the spasm for months, yet there was quite early resumption of normal facial motions following the temporary paralysis in the supply of the facial nerve.

We experience a similar result after injections of the fifth nerve in trifacial neuralgia. The analgesia induced by the injection soon passes off and yet the excruciating pain, which must be construed as sensory irritability in the nerve, fails to reappear in the variable period of from a few weeks to a year, and even more.

Returning to the case under discussion, I may tell you that the position of the injected limb is much better than the one on the opposite side. The degree of abduction is somewhat greater; the leg is everted, externally rotated, and slightly more flaccid. The patient has been more or less constantly in a plaster cast put on by Dr. Jacobs, but other measures, such as massage and re-education of the weak muscles, have not been employed. Neglect of these adjuncts to the treatment will certainly impair the result, and I wish to thank Dr. Schwab for the emphasis he has put upon the point of *early* efforts at walking after the injection. The reasons have been stated, and in those mild cases where walking or even standing is possible, early exercise, plus all other measures to promote muscle tone is of vital importance. But what of the severer, bedridden, scissor-leg types? Here I believe an early start at walking is entirely out of the question, because of the obstinate secondary contractures.

The second patient I saw for the first time in February last. She is now seated in the rear of the room. A young girl of fourteen years of age, presenting the characteristic features of a hæmiplegia, probably due to an encephalitis occurring in the early months of infancy. The posture, flexor contracture of the hand, spasticity, athetosis, and Babinski phenomenon point to a central lesion. To overcome the athetosis and correct the contracture of the hand I injected the ulnar nerve in its groove at the elbow, and immediately a spastic paralysis in the fourth and fifth fingers was changed into a flaccid one, with complete loss of pain and touch sense in the area of ulnar distribution. From time to time I have tested this sensory loss, and it remains quite as complete and definite, together with a distinct feeling of deadness and numbness, as it did immediately after the operation. I have not been able to persuade the mother to have the median and musculospiral nerves likewise injected. She claims, and with some justice, I think, that the child's distressing numbness and inability to grasp and hold a plate, for instance, in her flaccid hand, is more disabling than the original condition.

Dr. Schwab shows proper discrimination in the choice of cases that may be benefited by this treatment, and is, above all, to be commended for that wise conservatism which makes his method not a panacea for restoring all functions in paralyzed limbs, but merely a plan to correct deformity, readjust muscle balance and co-ordination, thereby rendering better function possible and giving some usefulness to an otherwise useless extremity.

Just a word in reference to posterior root resection as touched upon by Dr. Frazier. The most striking thing to me about the entire application of root resection in spastic paralysis is that for the first time an attempt is made to relieve a motor disability through a sensory mechanism. As to the question of the ataxia likely to be induced by resecting the roots, I think the cutting of alternate roots, or at least leaving one or two intact, lessens to a great extent any subsequent show of incoordination. It is quite true that operation artificially induces a tabes in these cases, but neither Förster nor his followers in this work have noted ataxia as a prominent or permanent symptom. Since becoming familiar with the theoretical problem, I have wanted to learn something of the

technical side of root resection, and to that end had asked Dr. Kanavel to test out the comparative value of Dr. Frazier's operative suggestions on laminectomy and Dr. Taylor's so-called unilateral opening. The latter seems to me entirely feasible and from the cadaver work kindly done by Dr. Kanavel I should say that there was enough accessible space in the section of roots to be cut. Whereas the operation may not be a supreme test of surgical skill, nevertheless it requires a deft hand, and, above all, great care in the recognition of the root or roots in question.

In closing, I desire to add a sense of my personal obligation to Drs. Frazier, Schwab, and Allison for giving us the splendid contributions to a new chapter in neurologic surgery.

DR. LEWIS J. POLLOCK: I have been very much interested in the method that has been described by Drs. Schwab and Allison this evening, for the reason the cases I have had under observation have been unsatisfactory from the standpoint of after treatment. In other words, they are cases of Little's disease that cannot be re-educated in the beginning, and I decided simply to try alcohol injection into the nerves to determine exactly what results could be obtained, aside from tenotomies or tendon transplantation. In all, we have had six cases. The first case was one of Little's disease which we saw with spastic paraplegia, with athetosis of one arm, the forearm flexed, and slight spasticity in the opposite arm, with athetoid movements. In this case we injected thirty minims of eighty per cent solution of alcohol in the ulnar nerve, and sixty minims in the median nerve, following which the spasticity disappeared. The condition of the hand after injection was that of entire flaccidity. There is no deformity. The patient has total anæsthesia in the area supplied by the median and ulnar nerves, and up to date she has slightly regained some sensation for pain, especially along the outer side of the thumb, and along the inner side of the small finger. However, there is no return of function. I shall be conservative in resorting to these injections in case further experience shows that motor function does not easily return or soon will return.

The next case was a girl, seventeen years of age, who likewise had spastic quadruplegia. There was no cross-leg paralysis, but in the upper extremity she had marked spasticity of the flexor group of muscles on both sides, and injection was made on one side into the ulnar nerve, and into the median and ulnar on the other side. It was rather remarkable to see the difference. On one side we have free supination and pronation, whereas on the other side pronation meets with resistance. The deformity has not disappeared. The position of the hand relative to the forearm is the same as before the injection. I think in those cases of spastic paralysis, where we have shortening or contracture of muscles or tendons, the nerve injection does not suffice to correct the deformity. It is true, it will relieve spasm, but not correct the deformity, and here we may do tenotomy or tendon transplantation, and I think future results will bear out that statement.

The next case was a boy, eleven years of age, with Little's disease, with spastic paraplegia, and markedly cross-legged. These cases of pastic paraplegia had never walked and had very little mentality. I have some pictures which I should be glad to show. The legs cross one another; the knees are flexed equally at an angle of one hundred degrees. An injection was made here into the obturator nerve. The technique was practically the same as that used and recommended by Dr. Schwab, except I made the incision slightly to the inner side, that is, on the outer border of the adductor group of muscles, and injected seventy-five minims of eighty per cent solution of alcohol on each side. Immediately there was a relaxation of the adductor spasm, and the legs lay parallel. He has not been able to walk, nor has an attempt been made to do so. He barely moves his legs. We had a slight infection in this case, due to the fact that we were not able to protect the part from urine.

Another case was a boy, twenty years of age, who had quadruplegia, who has no cross-leg paralysis, but who has distinct adductor spasm. Here abduction can be accomplished only to a degree by lacing two fingers between the two knees in extreme abduction. Here we injected sixty minims of an eighty per cent solution of alcohol into the obturator nerve on the right side. There was no relaxation of the adductor spasm. On the other side we injected sixty minims, with no relaxation. To show that the nerve here was not responsible for the position, I cut the obturator nerve upon the left side, and the patient to-day is in the same position as before the operation. Probably there is slightly more freedom in motion in his attempt to abduct the legs, but the distance of abduction is no greater than before.

Another case, a girl, eighteen years of age, with quadruplegia, was injected by Dr. Hecht. She had cross-leg paralysis with a deformity which I cannot very well describe. In the lying posture looking at the case from the feet, it seemed just like a conglomeration of feet and knees. She had right arm deformity. There was flexion of the hand upon the forearm, the forearm being in supi-

nation, with athetoid movements. She was injected on one side by Dr. Hecht, and on the other side by me. We injected both branches of the obturator nerve. We isolated ulnar and median nerves, and injected upon the side which had deformity and athetosis, with very little, if any, result. The deformity remains the same both in the lower extremities and in the hands.

It seems to me from the cases I have seen early, before contracture or shortening has set in, muscle group isolation is admirable, and the result which we have obtained in one case of spastic paraplegia, from the standpoint of position, can hardly be improved on. In those cases where shortening has occurred, injections of alcohol will not benefit them alone. The injection method should be supplemented by tenotomy or by a tendon transplantation operation.

I was glad to hear emphasis placed upon further treatment, namely, re-education, and even if there is a tendency to spasm or to athetosis, if we re-educate we can hope for better results.

I wish to state that the operations which had been done at the Cook County Institution have been with the assistance of Dr. E. B. Jewell.

DR. M. L. HARRIS: I would like to mention two cases which do not bear directly on the subject of spasticity or athetosis, but relate to the length of time which we may expect effects after alcohol injections. Since the injection of nerves with alcohol has come into vogue, I have seen two cases of inoperable carcinoma of the breast, with axillary metastases involving the brachial plexus, with the production of excruciating and continuous pain. In these cases I cut down upon the brachial plexus in the neck and injected the roots of the brachial plexus with alcohol. The immediate effect was very satisfactory. The paralysis was complete, and the anæsthesia was complete in the arm. Unfortunately, however, it was of short duration. Pain returned before the motion, and within six weeks the pain was just as bad as ever, so that I had to cut down upon the brachial plexus again and resect, so that in these two cases the effect of the alcohol injection was of short duration. Perhaps the peripheral irritation with compression of the nerves has something to do with the length of time the effect of the alcohol lasts.

DR. JULIUS GRINKER: I would like to ask Dr. Schwab in closing to tell us how long after the operation there is paræsthesia, or how soon paræsthesia develops after the anæsthesia. This question is prompted by an experience of mine in a case I had at Wesley Hospital in a woman, forty years of age, who developed hæmiplegia about four years previously, which resulted in late contractures, more marked in the arm than the leg. She had a spastic hæmiplegic gait, and the arm and hand troubled her greatly. The contracture was so intense that the fingers were buried within the palm of the hand and gave her a great deal of discomfort and pain. I made an injection, according to Dr. Schwab's directions, in the median and ulnar nerves, put up the arm temporarily in plaster of Paris, and she made a prompt recovery from the operation. The fingers relaxed at once and have remained so. Dr. Patrick and I saw her after the operation with the fingers relaxed. I had occasion subsequently to see the patient and she showed some improvement in motion. She could move the thumb slightly, which she could not do before. The hand has remained extended. With the exception of this slight return of power in the thumb the paralysis has not improved. She is now in the country. The patient was so pleased with the result we had accomplished in her case, that she said if there never should be any return of power the operation was worth while because her hand was straight and did not dig into the palm, causing wounds. She subsequently complained bitterly of pain in the arm and hand in the region of ulnar and median distribution. Up to the present I have not succeeded in removing this troublesome symptom.

I would be pleased to learn Dr. Schwab's experiences with such cases.

DR. SIDNEY I. SCHWAB, St. Louis, Missouri (closing the discussion on his part): I will first answer the question that has been asked, because it is a very important one. In our series of cases we have had no case of paræsthesia, but that does not mean that we may not get them. I have no ready explanation to account for it except perhaps it was owing to the strength of alcohol used. Did you use eighty per cent?

DR. GRINKER: Yes.

DR. SCHWAB: I do not know just why you should have paræsthesia. Perhaps your incisions over the nerves in healing left some slight adhesions or something of that kind which may have accounted for the paræsthesia, but we have had no such experience in regard to alcohol injections.

There are a few words I wish to say in conclusion. I want particularly to emphasize the fact that what we call muscle group isolation or alcoholization of nerves is not intended as a cure. Spasticities of groups of muscles are things we cannot attack surgically in a great majority of cases, but what we try to do is to get the spastically contracted leg or arm in the best possible functional position, in order to proceed with the re-education and exercise of the muscles that were not paralyzed;

our whole aim is of this nature, and we believe from our experience that we can do this more rapidly and with less danger to the patient by attacking the peripheral nerves than we can by any other means, and the most essential part of this operation is the physiological part, that is, the exercise, and massage, and re-education. We try to get the leg in as nearly normal position as possible, and in our experience these children walk with the legs slightly abducted, and by the constant use of the abductor group, while the adductor group of muscles is thrown out of business. We hope after a while to strengthen the adductor group so that the regenerated adductors will be strong enough to hold the leg to cause its own progression. Our experience has been in the cases operated on that there has not been a great deal of weakness in the adductor group of muscles. Most of the patients have been able to walk around the ward with the legs abducted in from three or four days to a week after operation.

I want to emphasize the fact that our experience has been largely with children. In children who have been spastically paralyzed the operation, as described so clearly by Dr. Frazier, is an operation we feel we do not dare or care to attempt on that class of cases. These children do not stand operations very well. I feel quite sure, furthermore, that these cases would not stand posterior root resection. I think the mortality would be so great in these cases that we would not be justified in carrying it out. The cases reported apparently have been in adults, and I think perhaps that is a distinction. Theoretically, I will simply say that there is a great deal of objection, from the standpoint of the physiology of the nervous system as we know it, against the operation advised for the cure of spasticity by posterior root resection. Among the objections are these: In the first place, if you cut the posterior roots alone, you run the risk of depriving a group of muscles of sensation, because it has been clearly shown that while the motor nerves carry sensory nerves as well, in order to produce sensory paralysis, you might say, you must cut the anterior roots as well. But that would be ridiculous. If, on the other hand, you are able to produce perfect anæsthesia in a segment, you would be producing a thing that is contrary to the purpose of the operation. There has been one case published in which ataxia was produced by posterior root section, although I forget the name of the author who has reported the case.

Dr. Charles H. Frazier, Philadelphia (closing the discussion): I have very little to add to what has been said. It is quite evident from the direction the discussion has taken, that the alcohol injection method of treating spasticy is more popular than posterior root section.

In my paper I not only presented to you what experience I have had in this work, but I laid before you the experience and results of others. I realize, as you all must, that a laminectomy is a serious and formidable procedure, one only to be used in certain selected cases and those of the more severe grade. I believe, however, that the mortality should be almost a negligible quantity. There have been no fatalities in this country. The two reported deaths were in cases operated upon abroad. Some mention was made of the danger of this operation, especially in children. I do not advance this as an argument, but it so happens that the fatalities from posterior root section have been in adults, whereas the deaths from alcohol injections, according to Dr. Schwab's statement, occurred in children.

As regards the technique of the operation: I am not in favor of the unilateral method, even with an ample exposure. Some operators have found it difficult to identify the roots, and still more difficult to completely isolate the posterior from the anterior roots. Those of you who have had any experience with this operation will realize that the separation of the posterior from the anterior root is not as easy; because they make their exit from the cord through the same channel, and in some instances the posterior root may be represented by several bundles of fibers, so that it is difficult to determine whether you have divided all the sensory bundles. In one case, where I thought I cut the entire sensory root, I probably must have left one or two bundles behind, and therefore in that case did not absolutely abolish the spasticity.

Simple division of the posterior root will suffice in most cases. Furthermore, it is unnecessary, as Dr. Schwab inferred from his observations, to produce complete anæsthesia. In fact this is an undesirable condition, and for this reason we leave undivided every third root.

I have tried to present the subject in a fair and impartial way, and it may appear that I am not a warm advocate of the method. I should prefer to reserve my opinion until sufficient time has elapsed to determine how much functional activity is restored. I am quite sure there will be no return of the spasticity, but how much function will be recovered by education, exercise, and other means remains to be seen.

TRANSACTIONS OF THE CHICAGO GYNECOLOGICAL SOCIETY

STATED MEETING, MARCH 25, 1910, DR. CHANNING W. BARRETT IN THE CHAIR

DR. HERBERT M. STOWE, EDITOR

CARE OF THE MAMMÆ DURING THE PUERPERIUM

DR. C. S. BACON read a paper on this subject,

DISCUSSION

which appears in this issue. (See p. 264.)

DR. H. M. STOWE: I have had a number of cases recently in which the nipples were not very prominent; in fact, they barely protruded from the breast itself. I feared that the child would have considerable difficulty in nursing. Prior to the past year, these women under my care have experienced much trouble in nursing and at times I was compelled to remove the child from the breast.

During the last year, however, I have been using the Bier nipple pump for these retracted or poorly developed nipples, with success. The patient is instructed to apply the pump to each nipple for a period of fifteen minutes every morning and evening during the last month of utero-gestation. By this means, the nipple tissues are relaxed and stretched. The nipple does not stand out from the breast after this treatment. When lactation commences in the puerperium, the child is enabled to grasp the nipple more firmly and is better able to retain it in the mouth while nursing after the Bier treatment. If the child must bite and chew the nipple in order to hold it, fissures and cracks are liable to occur and cause the mother great pain and discomfort.

DR. RACHELLE S. YARROS: Dr. Bacon has covered the ground so well that there is little to add. It seems to me that the application of ice has yielded better results, even where there was a rise in temperature and local tenderness, all the evidences of pus formation.

Dr. Bacon said something about making a small incision into the abscess. If the abscess is small, a short incision is sufficient, but my experience has shown that when there is a large accumulation of pus, it is better to give a general anæsthetic and make a large incision, so that one may break down all the little pockets and eliminate the necessity for the old-fashioned drainage.

DR. STARK, of Portland, Oregon: I would like to ask Dr. Bacon what he is going to do if the woman absolutely refuses to nurse her baby. I do not know of any way to force her to do so. Common-sense might be brought to bear, but suppose she has little? This is a serious question. At the Rotunda Hospital they are somewhat old-fashioned in arresting the flow of milk. They use medicines and applications — camphorated oil and belladonna ointment. They seem to consider their use absolutely necessary in all these cases. Dr. Tweedy, the master of the Rotunda Hospital, is very particular in the management of his cases about feeding these children by the clock. He insists that the child shall be put to the breast every two hours to the minute, no matter whether it is asleep or not. If the nurse or mother feels that the child is getting too much food because it regurgitates, he tells them to feed it a shorter length of time. Although we may shrug our shoulders at his methodical way, he certainly obtains marvelous results.

As to the incision of abscesses at the Rotunda Hospital, they make a large incision, but without any anæsthesia, except perhaps a local anæsthetic. They usually have an assistant hold the woman's hands and then do it as quickly as possible, pass in a gloved finger and break down all the pockets. They insist on this. Then they pack tightly for twenty-four hours. Then, no matter what the condition is, they remove the packing, irrigate the cavity and pack again, but very loosely. This second packing is removed after twenty-four hours, and so on, until at the end of three days the packing is dispensed with. The results are cures in one hundred per cent of the cases.

DR. GUSTAV KOLISCHER: Dr. Bacon was the first man in this city who concisely stated years ago how we should take care of mammæ during the puerperium, under normal and abnormal conditions. That his methods are valuable is proven by the fact that prominent obstetricians have accepted his methods. What impressed me particularly in the paper were two points. One was the emphasis he placed on the necessity of doing more prophylactic work and dispensing with the fallacy of trying to disinfect an infected area. We have been taught to disinfect infected nipples by means of all kinds of so-called antiseptics. For instance, much stress has been laid on the use of boric acid, which we know is innocuous. Second, we should stop fussing with the nipples, because the openings of the milk ducts are merely avenues for infection to enter. Therefore, it is better to let the nipples alone.

With reference to incision of the gland after sup-

puration, the first man who theorized much on the location of the incision, its size, and so forth, was Albert, of Vienna. He said that no matter whether it is a mammary abscess, whether retromammary or elsewhere in the secreting tissue, we should always try to make the incision at the highest point, contrary to the general rule, which tells us to make it at the lowest point to secure drainage. If you make the incision low down, the weight of the mammæ will compress the lowest part of the abscess and prevent drainage. If you make the incision at the top of the abscess, this compression forces the pus out through the incision.

As to the size of the incision, the main point is to break up all the fibrous trabeculæ in the cavity to prevent retention and re-formation of pus. The incision should be large enough to permit of the introduction of the finger, so that these pus pockets can be broken up readily, and to allow of drainage by either gauze or tube drain. It is of course necessary, for cosmetic purposes, to make the incision in a radiating direction. The application of ice is quite valuable, but very often the application of the ice pack or of cold applications is followed by untoward complications, such as freezing the skin, etc.

I am very glad that Dr. Bacon does not favor the Bier treatment. I have seen very disastrous results following it. After once the breaking down of tissue occurs, we get splendid results, at least in shortening the time of healing, by applying a big suction pump, although, as stated, in a few cases very disastrous results have followed the application of a constricting tube around the mammæ before the milking function was absolutely established.

DR. BACON (closing): I was interested to hear Dr. Stowe mention his treatment of depressed nipples. I am willing to admit that a proper and systematic use of the Bier method might help somewhat. In general, I would say that the nipple seems to be drawn out much more easily after lactation is started, and I have come to the conclusion that it is best not to bother very much with it beforehand.

The bad results that follow the ordinary management of abscess are due to prolonged drainage. To incise a large abscess, I believe that, as a rule, a general anæsthetic should be given, so that a sufficiently large opening can be made and all the pockets broken down. With the use of suction, drainage can be very much improved.

I do not know just how far one should carry the breaking down of the partitions. I think sometimes that is carried to the extreme. More injury is done to the breast than is necessary. However, in my paper I referred particularly to the small abscess. As soon as the presence of pus is determined, instead of waiting until the sac is broken down, open immediately and make a small incision, one which will close quickly. It is not necessary to drain more than two or three days, and the smallest amount of drainage that will answer the purpose is sufficient.

The problem of the management of women who refuse to nurse is a perplexing one. There is really nothing to do except that we try to exercise our functions as teachers as much as possible. Women ordinarily do not know much about the importance of nursing. They imagine that artificial feeding is every bit as good as natural feeding. If we can make them understand the danger and the risk incident to artificial feeding, there are few women who would not make an effort to nurse the child. It is largely a matter of ignorance. Therefore, we must patiently educate these women and make our influence felt.

In regard to the regularity of feeding, we ordinarily get good results from the observance of a regular feeding schedule in the hospital. In our private work this is not so true. If we weigh the child and determine exactly how much nourishment is taken, we will find that children vary much because of the amount and quality of the milk and the needs of the child. So that it seems to be rather unreasonable that they should be made to conform to a set schedule. I have had children do very well on a seven feeding schedule, and even on six, and I see no reason why the child should be forced to be fed more, if it does very well with less. It is a very simple matter for the physician to study each individual case and adopt a schedule for that child, based on the progress the child is making. On the other hand, there are children who must be fed often. A weak or premature child will starve if it is fed only every two hours, particularly when it does not get much milk. These children need relatively larger quantities of milk, twice as much, in fact, as a full term, well developed child.

In regard to the use of ice, it is certainly valuable in many conditions of breast management, in congestion and when establishing lactation, as well as in infections. It is necessary to protect the tissues to a certain extent. A large bag that will fit over the breast is better than a small one. The bag is laid over the infected area and is moved from side to side, as may be necessary. The Bier treatment, used at the beginning of the infection, before there is breaking down of the tissues, does not seem to do very well. I have seen it used in a number of cases, and am convinced that it caused a great deal

of pain to the patient, and, on the whole, was not satisfactory.

THE ABDOMININAL WALL AFTER DELIVERY AND THE PREVENTION OF ABDOMINAL INSUFFICIENCY AND THE NEURASTHENIC STATE

DR. H M. STOWE read a paper on this subject which appears in this journal. (See p. 269.)

DISCUSSION

DR. C. S. BACON: This method of strengthening the wall of the abdomen is most valuable. The occasional use of electricity in the more difficult cases is undoubtedly also of value. But I believe that even the weakest abdominal wall can be made quite strong by the use of electricity, and by exercise. But one thing is important, and that is the method of getting the patient up on her feet. The common practice is to have the patient sit in a chair for two or three hours. That is harmful. The patient should be out of bed for a short time only — a few minutes, and walk around a number of times, hold herself rigid and keep the abdominal muscles on the stretch. Increasing the number and length of periods of getting around gradually, according to the progress of the case, and then for a long time insisting on the horizontal position when the woman is nursing the child, is good treatment. The use of the bandage is undoubtedly valuable, but if used continuously it weakens the muscles rather than strengthens them. I presume it is intended to be used only when the woman is around and when tension cannot be kept up voluntarily. Of course, exercise should be continued for a long period of time.

DR. GEORGE SCHMAUCH: Comparing conditions in this country with those existing in Germany, we see here not so many cases of complete relaxation of the abdominal muscles. In Germany we do not make much use of the abdominal binder. Exercises are very good to strengthen the muscles, but I do not know how much they would affect the fasciæ. I was always inclined to regard weakness of the abdominal walls as a constitutional disease like rickets. Therefore, exercising will not help very much. The only way to treat this condition is to keep the patient in bed as long as possible and then let her wear a bandage for five or six months.

DR. STOWE (closing): The abdominal binder is intended merely to temporize and afford sufficient counterpressure to the intra-abdominal tension until the muscular walls have regained their former strength. I have never used electricity but believe that it is of value in certain cases when associated with gymnastic exercises. If the patient is generally and constitutionally weak, no operation or other method of treatment will restore her to perfect health, but active movements will often prevent her from becoming worse than she was before pregnancy. These patients should be kept in bed longer than the usual time and after they get up they should wear an abdominal support for a long time — for months or years. While it is true that a binder will eventually weaken the abdominal walls to a certain extent, the relief from the neurasthenic disturbances is of great value, at least from the patient's standpoint.

It is a common practice for the physician to consider his work completed when the child is delivered and the mother is seen once or twice during the puerperium. This is unfortunate. While it is of great benefit to deliver a living child, the physician's care should not be relaxed. He should keep her under observation during the period of involution — at least six weeks — and pay special attention to those organs and tissues that have been involved in the phenomena of uterogestation. At that time, a careful examination of the patient should be made and if those tissues and organs have been restored to their former non-pregnant, normal condition, the patient may be discharged; otherwise, further means should be instituted tending toward their restoration or improvement, in order that the patient may not become a burden to herself and a source of anxiety to her family and friends.

ABSTRACTS OF CURRENT LITERATURE

DEPARTMENT OF SURGERY

UNDER THE CHARGE OF

FREDERIC A. BESLEY, M. D.

GEORGE E. BEILBY, M. D. — WM. R. CUBBINS, M. D. — AIMÉ PAUL HEINECK, M. D.
WM. C. DANFORTH, M. D. — FREDERICK G. DYAS, M. D. — G. T. COURTENAY, M. D.
FRED C. ZAPFFE, M. D. — JAMES F. CHURCHILL, M. D. — B. J. O'NEILL, M. D.
ARTHUR B. EUSTACE, M. D. — JOHN A. WOLFER, M. D. — H. A. POTTS, M. D.

TUBERCULOSIS OF THE KIDNEY

A REVIEW OF RECENT LITERATURE

BY JOHN A. WOLFER, M. D.

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The subject of tuberculosis of the kidney, which was not so long ago considered a purely medical topic, has within the past few years become an issue confronting the surgeon. Probably in no condition has there been such a radical change in such a comparatively short time. Most of the profession are now agreed that tuberculosis of the kidney should be dealt with by the surgeon, and that in early and prompt surgical interference lies the solution of the problem. Not only has there been a decided change in opinion regarding the treatment but also as to etiology and diagnosis.

The consensus of opinion now is that a tuberculous infection of the kidney is a hæmatogenous infection with the primary focus elsewhere in the body. But the question still confronts us — why should only one kidney be affected primarily when there are tubercle bacilli in the circulation, or why should the kidney be affected and not the spleen or liver — and we know the latter conditions are a pathological rarity, unless a part of a miliary tuberculosis.

Wildbolz is still of the opinion that renal tuberculosis can be an ascending affection and by conducting a series of experiments on animals by injecting tubercle bacilli into the bladder, he formulates the following conclusions:

1. Injection of tubercle bacilli into the ureter can produce a unilateral renal tuberculosis, even when there is no obstruction to the urinary flow.

2. The renal infection appears to develop by the tubercle bacilli ascending directly to the kidney.

3. If the ureteral wall be inoculated at its lower or middle third, an ascending renal tuberculosis will follow only after rupture of the tubercular focus into the lumen of the ureter.

4. The injection of tubercle bacilli into the bladder will produce a bilateral ascending renal tuberculosis.

5. If one ureter be ligatured beforehand, only the kidney with the open ureter will develop tuberculosis.

6. Experiments on animals point to the conclusion that an ascending renal tuberculosis can develop in the human subject.

Bumgarten, after conducting a series of experiments, is unable to produce an ascending infection, and Brougersma in reporting a case of tubercular cystitis where both kidneys were found normal at operation, firmly asserts that renal tuberculosis is not an ascending infection.

Tendeloo tries to reason the infection as a lymphatic process and reports 71 cases of unilateral renal tuberculosis, 62 of which had either a pulmonary tuberculosis or a tubercular pleurisy on the same side.

Such conditions as trauma, intoxications, or low grade pus infections tend towards renal tuberculosis by decreasing the resistance of the organ, and bear the same relation to the pathological process as they do in tuberculosis of the joints, the pleura, or peritoneum.

Rosenberger thought for some time that he had a solution to the problem by finding tubercle bacilli in the circulatory blood of all tubercular patients, and that there was necessary only the localized lowered resistance to an organ or anatomical part to produce a tuberculosis of that part. His theory has been exploded by every other investigator.

Blum classifies renal tuberculosis from a pathological point of view as follows:

1. Miliary tuberculosis.
2. Infiltration tuberculosis.
   a. Massive nodular.
   b. Caseous.
   c. Cavernous ("pyonephrosis tuberculosa").
3. Lesion in uteter or pelvis leading to hydro- or pyonephrosis tuberculosa.
4. Where the whole kidney is caseous due to total obstruction of the ureter — "autonephrectomy" of the French.

The clinical symptoms depend upon the nature of the pathological process. If the process is limited to the tips of the pyramids, we may have an almost symptomless disease, at least so far as the kidney affection is concerned, but so soon as the focus extends into the pelvis then marked urinary changes may be observed, and we then find the characteristic pyuria and hæmaturia of an apparent unknown origin. This brings us to the subject as discussed by Gallavardin and Rebatti, when they speak of open and closed renal tuberculosis, although in closed tuberculosis must also be considered those cases of obstruction of the ureter with retention of the contents, and also those cases of so-called healed tuberculosis where the tubercular contents are encapsulated, or in which the whole kidney is destroyed and replaced by caseous material and connective tissue. Such a case is reported by Ekehorn where, eight and one-half years after onset, the patient returned to the hospital with a complete symptomatic recovery. The urine was absolutely negative. Cystoscopic examination was negative, except that there was no flow of urine from the ureter on the afflicted side. At operation, the entire kidney was found to be replaced by a sac of caseous material.

The entity — tubercular nephritis — may be classed among one of the above, although, as pointed out by Gallavardin and Rebatti, ther emay be a toxic nephritis, due to the specific toxins of the tubercule bacillus. The later form is quite frequently found in unilateral renal tuberculosis and promptly subsides when the offending organ is removed. Those cases which give the symptoms of chronic nephritis — viz., albuminuria, hypertrophy of the heart, and arterial hypertension, and pathologically contain tubercular foci, must simply be classed as renal tuberculosis, at least from a pathological standpoint.

The fact that places itself most forcibly in the minds of surgeons is the insidious onset of the symptoms and stress that should be placed on a bladder irritability with an unknown cause. This prompted Casper in stating: "A recurring hæmaturia of obscure origin, and above all, every case of pyuria in which the urine does not promptly clear up or at least improve under appropriate treatment excites suspicion of tuberculosis of the urinary apparatus." According to Harris, the early bladder symptoms are not caused by lesions in the bladder but are "irradiation symptoms."

There is a marked variability in regards to the symptomatology. Krotoszner makes a strong point of the pain and especially when on either side of the abdomen, at the crest of the ilei, or in the femur or sacrum. If this pain is accompanied by bladder tenesmus with persistence of pus with blood in the urine, we must strongly suspect renal tuberculosis.

Many of the patients are in good state of nutrition, in fact Chute reports two cases in which the patients were in the best state of nutrition.

Without exception every investigator strongly advocates the use of the cystoscope and the ureteral catheter. By this means is not only located the site of the infection, but the functional activity of the opposite kidney can be determined if indigocarmin is injected while the catheters are in position. In the early cases, and in making early diagnoses lies our chance of materially shortening the course of the disease; the bladder may be negative. There may be a slight puffiness about a ureteral orifice, but unless one is skilled in doing cystoscopic work, this might readily be overlooked. We must now devote our attention to the urine from each kidney. In the majority of cases the tubercle bacillus will be found. If one is not successful in this there is always available the animal for inoculation.

Condon digests the sediment before examining for tubercle bacilli. He uses the solution recommended by Pettit: pepsin scales, 2, glycerine, 11. HCl, 10, sodium flouride, 3. H_2O q. s., 1000 cc. The sediment is added to 100 volumes of this mixture and incubated

at 38° C. for 24 hours. This dissolves all except bacteria and nuclei, and makes the organisms more readily found.

As before stated the urine from a tubercular kidney may be normal if the lesion does not communicate with the pelvis.

Hottinger pays much attention to the specific gravity, color, reaction, quantity, and macroscopical appearance of the urine from the ureteral catheters, and says that frequently a highly probable diagnosis can be made from this alone.

Chetwood strongly advocated functional tests for the kidney and classifies the tests as follows:

1. Qualitative tests:
   - *a.* Cryoscopy.
   - *b.* Estimation of percentage of urea.
   - *c.* Phloridzin test.
   - *d.* Indigo carmin test.
2. Quantitative:
   - *a.* Total volume of freezing point.
   - *b.* Total urea.
   - *c.* Total sugar elimination.
3. Experimental polyuria — (for this he formulates the following rules):

a. A diseased kidney has a more uniform function than a healthy kidney, and its function varies less from one time to another, the more extensively its parenchyma is destroyed.

b. If one kidney alone is diseased or is the more diseased of the two, when the urinary function becomes disturbed, it modifies its function less than the other.

He points out that there may be a complete absence of sugar elimination from a healthy kidney, by a reflex or toxic influence.

By functional tests can be determined not only which kidney is diseased but to a great extent how much kidney tissue is left and whether the opposite organ does compensate.

In the female it is quite frequently possible to palpate the thickened ureter per vagina, also to palpate the enlarged kidney — but in the latter we must not forget the possibility of the healthy kidney being enlarged — a compensation hypertrophy while the diseased organ may be smaller than normal. Cumston says that when the diseased organ is enlarged it is usually due to a perinephritis, this causing a thickening of the capsule with adherent perirenal fat.

Karo tells us that the subcutaneous injections of tuberculin causes pain in the region of the diseased kidney and Israel finds that the use of tuberculin causes an increase of urinary symptoms, and it may be that only then is one able to find tubercle bacilli in the urine. If this process is bilateral he then thinks it a question whether a nephrectomy should be done.

Fenwick has been able to accurately outline a caseous kidney by use of the X-ray, and in this case the patient complained of pain on the opposite side. The pain can probably be accounted for by an active hyperæmia of the healthy kidney.

In the treatment of tuberculosis of the kidney most investigators are agreed on the fact that early nephrectomy is the only safe and reliable method. Cheney says: "Early diagnosis and early nephrectomy after exact tests of the function of the other kidney—these are now conceded to be the essentials for successful treatment."

Blum reports a series of 26 cases which were not surgically treated, with 24 deaths within 5 to 6 years and says that medical treatment is a waste of precious time and diminishes the chances of operation. He further shows a decrease in the mortality rate following nephrectomy which he attributes to early diagnosis by use of the ureteral catheter and functional tests of the kidneys. He quotes the following operations:

Brodeur....	1890	58 per cent mortality
Palet.....	1893	40 per cent mortality
Pousson.....	1902	29.4 per cent mortality
Schmieden....	1902	31.3 per cent mortality
P. Wagner....	1905	24.5 per cent mortality
Blum.....	1907	13.3 per cent mortality
Blum.....	1908	11.1 per cent mortality

Formerly the condition was rarely diagnosed as shown from records from Wiener Allgemeinen Krankenhaus from 1893 to 1902. In 20,770 autopsies there were found 191 cases of renal tuberculosis and only 6 had been diagnosed. Sixty-seven of these were unilateral and may have been successfully treated surgically.

There are recorded some favorable results with tuberculin. Pillicke reports two cases of tuberculosis of the kidney with apparent recovery and advises when possible to give the patient a course of treatment with Koch's old tuberculin. This must be understood to be a symptomatic cure, and that there is still present either a focus which can become active or a sac of caseous material and no kidney tissue as in a case previously referred to by Ekehorn. Fenwick says: "Eighteen years' experience with tuberculin has proven to me it rarely cures urinary tubercle." He does make the statement that it allays the distress of early tuberculosis.

As Blum has pointed out, spontaneous healing must be after one of the following methods:

1. Calcification.
2. Sclerosis and surrounded by fat.
3. The spontaneous emptying of the tuberculous cavity and partial obliteration by a pyogenic membrane.
4. Obliteration of ureter and caseation.

Albarran nevertheless says: "There is not a single anatomical specimen showing spontaneous healing."

Blum places the following contraindication to nephrectomy:

1. Old age of patient; mortality high; due to arteriosclerosis and heart change; other kidney in poor condition.
2. Generalized miliary tuberculosis.
3. When patient is in such a condition, by other disease such as diabetes, that he cannot withstand the operation.
4. Marked pulmonary tuberculosis.
5. When the tubercular process has involved the genitalia and bladder (the subject of controversy).
6. Bilateral renal tuberculosis — (if one is very

markedly involved and the other only slightly then often removal of the bad one gives good results).

The operation of nephrotomy is limited to a very few cases and should always be followed by a nephrectomy. Walker gives the following indication for nephrotomy:

1. When there is profuse or prolonged hæmaturia.
2. When there is serious toxæmia by the retention of infectious material in the kidney.
3. When there is intolerable pain not amenable to medical treatment.

Harris shows very clearly why a partial resection is useless by stating that one large focus is usually surrounded by microscopical foci.

When there is marked bladder involvement Rovsing advises flushing of bladder, then instilling 50 cc. of a 6 per cent carbolic acid solution at 95° F. Some men do not advocate local treatment and Ekehorn says the bladder symptoms will subside with extirpation of the tubercular kidney.

Pancreatitis from the Standpoint of the Clinical Surgeon. A. J. OSCHNER. *Journal A. M. A.*, vol. liv, 22.

Dr. Oschner in dealing with this subject draws the following conclusions:

1. A clinical diagnosis of chronic pancreatitis is usually possible before operation.
2. This condition is practically always a complication of gall-bladder or gall-duct disease, except when following metastatic infection.
3. It is usually curable by relieving the pathological condition of the gall-bladder and ducts.
4. An operative diagnosis of acute pancreatitis can often be made.
5. Early operation greatly improves the prognosis.
6. It is important to reduce to a minimum the trauma in these cases.
7. The important factor in the treatment consists in the establishment of free drainage.

ARTHUR B. EUSTACE.

Tuberculosis of the Neck of the Femur in Childhood and its Relation to Hip Joint Disease (Die Tuberkulose des Collum femoris in Kindesalter und ihre Bezienungen zur Hüftegelenkentzündung). HENNING WALDENSTRÖM. *Nord. Med. Arkiv.*, 1909, bd. xlii, h. 3.

This article is a very comprehensive one, starting out with the anatomy. The principal points brought out in this are the blood and lymphatic supply to the neck and head of the femur. The blood supply to the lower portion has a separate artery to the head and to the neck, while the upper portion is supplied by different branches of the same artery. The lymphatics drain into the lymphatic glands about the external iliac vessels.

The report includes 80 cases, in which the tuberculosis was 22 times primarily located in the neck, 3 times in the head, 28 times in the pelvic bones, 15 times in the synovial membrane, and in 15 cases it was impossible to state the primary localization.

There are two types of tuberculosis of the neck of the femur. that of the lower portion of the neck and that of the upper portion. The location in the lower portion is the more frequent and almost always contains a sequestrum. Owing to its position within the joint cavity it sooner or later ruptures into this and causes marked destruction to the head of the femur. The joint cavity remains relatively uninjured. The localization of the upper portion of the neck is neither so common nor so dangerous. In regard to the symptoms produced by the two conditions, Waldenström says that on inspection where the localization is in the upper portion the trochanter is less prominent, while when the localization is in the lower portion, the opposite is true.

We must always think of an old tuberculosis of the upper portion of the neck of the femur in case of monarticular arthritis deformans of the hip-joint.

For the early diagnosis the first indication of the hip-joint disease is the limp. Following this we get muscular atrophy with spontaneous pain, and a localized pain on deep pressure; a pressure pain over the whole capsulary surface and a diminution of movement mark a synovitis.

The treatment depends largely upon the condition to be found. If the collection is in the lower portion of the neck and localized there, or if the involvement of the synovial membrane is slight, operation should be resorted to. It is possible also to operate in cases where the localization is in the upper portion of the femur.

The operation is performed in the following manner: The trochanter is removed and raised up; the sides of the wound are then carefully walled off with rubber tissue and the bone cavity cleaned out with a curette, and then sponged out with iodiform gauze. About 5 cc. of a ten per cent solution of iodiform glycerine are injected into the cavity, the trochanter replaced and sutured with silk or silver wire, and the wound closed with a small iodiform gauze drain which is removed at the end of four days.

The operative measures must be taken with extreme care in order not to rupture into the joint. This operation is advised because the synovial tuberculosis is much less virulent than is the bone tuberculosis, and the removal of the bone focus gives better chance of an early healing. The patient is placed in a plaster-of-Paris cast for about two months after the operation.

C. G. GRULEE.

Rectal Myomata (Des myomes du Rectum). F. DESCOEUDRES. *Revue de Gynécologie et de Chirurgie Abdominale*, January, 1910.

Muscular tumors of the intestinal walls are not of frequent occurrence. Like myomata of other segments of the digestive tube, they are classified into external and internal tumors. The internal tumors project into the interior of the organ, are pediculated and ovoid and more or less voluminous; they constitute polypoid tumors, the symptomatology, prognosis, and treatment of which in no way differs from that of other varities of polypi. The external myomata are at times very voluminous and their diagnosis is often very difficult, at time impossible. They are mistaken in the female

for tumors originating in the uterus and adnexa; in the male for tumors originating in the urinary bladder or in the prostate.

The author studied the literature on this subject and reports one personal observation.

The only treatment is complete extirpation of the neoplasm. Different methods have been employed. Some have laparotomized their patients and have obtained good recoveries. Others have performed a Kraske operation. In these cases, outside of fæcal fistulas lasting a shorter or greater length of time, recoveries have always occurred.

The selection of the sacral or the perineal route is indicated for tumors occupying the sacral excavation or the recto-vaginal septum. If the myoma point in the perineum one is influenced in his choice of incission by the point of emergence of the tumor. The author in his case circumscribed the base of the tumor by an elliptical incision. The tumor's pedicle was isolated by following through the pelvic floor the same route that the neoplasm had followed and the tumor entirely removed. The rectal defect which the removal of the point of origin of the neoplasm created was carefully closed by two layers of catgut suture. The pelvic floor was repaired, and a tube was left in the rectum for the passage of flatus. Recovery was uneventful. The anus was continent.

AIMÉ PAUL HEINECK.

Post-operative Results in the Treatment of Congenital Talipes Equino Varus According to Pascale's Method (Post-operative Resultate bei Behandlung des angeborenen Pes Equino Varus nach dem Pascal verfahren). DR. GUISEPPE D' AGATA. *Berliner klinische Wochenschrift*, 1909, 47, p. 472.

The mechanical bloodless methods of Lorenz and Wolff, which require the skilled hands of orthopedic specialists and a long period of time to produce results, are compared with the operative method of Pascale which the author believes to be the better method for practical surgeons. Pascale and Sappy made numerous observations upon cadavers and they concluded that in order to cure congenital talipes equino carus, the calcaneo-cuboido-scaphoidea articulation should be released and the strong, deep plantar ligament cut through at the same time.

Pascale's method is as follows:

1. An arch-like incision, maximum length not to be over 2–4 cm., is made along the inner border of the foot following closely the deformity. The point of the incision is opposite the talo-navicular articulation. With practice a shorter incision suffices.

2. The delicate part of the operation consists in merely touching the m. adductor brevis of the great toe and avoiding injury to the soft parts, especially the plantar artery and nerve, which are placed aside. This difficulty is mastered with ease if one takes as a guide and starting point the tendons of the long flexor of the great toe and of the flexor digitorum communis, which are in close relationship to the bony skeleton, and proceeds directly down upon the deep plantar ligament, especially upon the fibrous cartilage and the lower calcaneo-scaphoideo-cubiodal ligament.

3. The foot is stretched strongly dorsalward and with a bistoury, passing from the outside inward and upward, the deep ligaments of the sole are cut and the whole medio-tarsal joint opened, which is indicated by the yielding of the resistance of the whole forefoot.

4. Manual reduction and sewing of the different layers.

5. The first apparatus is put on after ten days and the second after about a month. The little patient is allowed to lift the foot and walk around, a procedure quite necessary because the weight of the patient helps maintain the position of the foot before the ligaments and other soft parts are fully regenerated.

Pascale's method has been followed in the surgical clinic at Naples during the last twelve years with the best of results. FLOYD B. RILEY.

On the Occurrence of Goiter (Active Thyroid Hyperplasia) in Fish. DAVID MARINE and C. H. LENHART. *Bulletin of the Johns Hopkins Hospital*, April, 1910.

As the authors state water has been associated with the cause of certain thyroid lesions since the earliest observations and writings on diseases of the thyroid gland. The list of substances which may be present in water in solution or suspension which have been assigned as a casual factor of goiter, are very numerous and include a great variety of organic and inorganic substances. This study was undertaken with the view of determining if possible whether there was any basis in fact for the common assumption that water is an etiologic factor in certain thyroid disease. They reasoned that, inasmuch as most land animals in goitrous districts have thyroid changes, the examination of fish thyroids in such districts might yield specific information as to whether water was or was not a factor in the development of goiter.

In the course of their investigations they examined mountain trout from Yellowstone Park, from Utah and California; sea trout and sea bass from the Atlantic ocean; goldfish from local dealers; pike, herring, bass, sheepshead and carp from Lake Erie. They observed thyroid changes only in the fish obtained from Lake Erie. (In a previous study by Marine it was demonstrated that a large per cent of the land animals in the Lake Erie region had thyroid changes.)

The authors draw the following conclusions from this study: 1. That in regions of endemic goiter the first may also be affected.

2. That the thyroid hyperplasias of fish react with iodin exactly as do the thyroid hyperplasias of the higher animals.

3. That the findings of these changes in fish is perhaps the most direct evidence that goiter may be associated with water. GEORGE E. BEILBY.

ABSTRACTS OF CURRENT LITERATURE

DEPARTMENT OF OBSTETRICS

UNDER THE CHARGE OF

C. S. Bacon, M. D. Herbert Marion Stowe, M. D.
Heliodor Schiller, M. D. C. G. Grulee, M. D.

Normal Human Blood Serum as a Curative Agent in Hæmophilia Neonatorum. John Edgar Welch. *American Journal of Medical Sciences*, vol. 139, No. 6.

Under the name of hæmophilia neonatorum the author reports a number of cases in none of which the hæmorrhage was due to traumatism. Stimulated by the high mortality rate in these cases and by the futility of all previous measures the writer decided to attempt the use of human blood serum which was done in twelve cases, all of which were cured of their "bleeding sickness."

The blood is collected under rigid aseptic precautions from a large vein at the elbow and drawn into a suction flask and the serum withdrawn as rapidly as it separates.

The dose of serum which is given by subcutaneous injections depends upon the urgency of the case. It is advisable to begin with at least 10 cc., and repeat three times a day if the infant is bleeding only moderately. In severe cases it should be given every two hours and in larger quantities if necessary. It is very important to begin treatment at the first indication of bleeding, however insignificant.

Normal human blood serum administered to tuberculous patients hypodermically also gives excellent results, as it contains more opsonin than that of a tuberculous patient, thereby causing a more complete phagocytosis. Arthur B. Eustace.

The Staining of Fresh Blood during Pregnancy, Labor, and the Puerperium (La colorazione vitale del sangue durante lo stata puerperale). Dr. G. Levi. *Folia Ginecologia*, vol. iii, 1910.

Levi examined stained fresh blood taken from 98 women, 30 of whom were normal and 68 manifesting morbid conditions.

His staining solution consisted of:

Brilliant cresyl-blue	gr. 0.02
Sudan iii	gr. 0.04
Absolute alcohol	gr. 20.

An ordinary clean slide was first thinly coated with the stain, and the alcohol evaporated by gently heating the slide. One drop of blood, taken from a finger or lobe of ear, was placed on a cover glass and immediately inverted onto the slide. Three cover glasses were usually placed on each slide, each cover glass containing one drop of blood. The central field of each cover glass was alone used for microscopical observation.

Levi advises filtering the stain each time before using same, as the Sudan iii tends to precipitate and may thus create confusion. His observations are all based on the researches of Cæsaris-Demel (Archivæ per le Scienze Mediche, 1905), who called attention to certain alterations in form and staining properties of leucocytes. He was able to demonstrate leucocytes with protoplasmic changes, both nuclear and granular, having an affinity for the brilliant cresyl-blue stain, and leucocytes presenting similar protoplasmic changes having an affinity for the Sudan iii stain.

He considered the first type to be that of albuminous degeneration, and the second type that of fatty degeneration of the leucocytes. From repeated observations of the above 98 cases, Levi draws the following conclusions:

1. During normal pregnancy the leucocytes containing fatty material (lipofores) attain a maximum of 8 per cent.

2. During normal labor there was no increase in the percentage of fatty leucocytes.

3. During normal puerperium in nursing and non-nursing mothers, the fatty leucocytes show a more or less marked increase, attaining a maximum on the second or third day, when the percentage may be as high as 18 per cent. From the fourth day on, the percentage decreases irregularly, until by the eighth or ninth day it has returned to the normal pregnancy level.

4. The number of previous pregnancies, the period of gestation, the duration of labor, and the weight of the fœtus, all have little or no influence on the number of lipofores.

5. These many observations establish beyond a doubt the fact that in pregnant women and in normal puerperæ, lipofore leucocytes are found in the blood in greater quantities than in the blood of non-pregnant women.

In pathological pregnancies and puerperii there is a constant increase in the percentage of lipofores in the circulating blood. In the presence of suppurative processes leucocytes containing large drops of adipose tissue with more or less marked alterations of protoplasm and nucleus, are found. (To these, the name of corpuscles of Cæsaris-Demel has been given by the Italian school.) There is also found a variable per-

centage of metachromatic leucocytes (i. e., having an affinity for cresyl-blue stain).

Regarding the significance of these findings, Levi follows Wright in interpreting metachromatic leucocytes as the result of hæmatogenous toxæmia or the product of bacterial action from intracellular digestion of the same. The presence of lipofores is accounted for by physiological involution of the uterus. The corpuscles of Cæsaris-Demel indicate fatty degeneration resulting from infection.

Levi believes that the routine examination of stained fresh blood during the puerperium may be of great value in diagnosing infection.

GEORGE DE TARNOWSKY.

Experimental Research on the Sterilization of Gloves (Experimentelle Beitrgäe zur Sterilization der Operations Landschue). PINCHUS BRAUN. *Beiträge zur klinischen Chirurgie*, bd. lxiv.

Braun conducted a series of experiments with the object of finding the safest method of glove sterilization. He wished, if possible, to find one which would relieve the operator of the disagreeable maceration which follows prolonged use of wet gloves, and made use of steam sterilization of periods varying from one-half hour to an hour and at a temperature of 100° C. and pressure of 0.7 atmospheres. Cultures of prodigiosus, staphylococcus albus, streptococcus, and pyocyaneous, of the vegetative forms, and subtilis and mesentericus vulgatus of the sporebearing forms were used. The gloves were packed in various ways — loosely, and folded tightly on themselves, empty, and filled with loose gauze packing and powder.

He finds the surest results are obtained by drawing the rubber glove over a cotton one in order that all the surface of the interior of the rubber glove may be held apart, allowing full contact with the steam. He states that times of exposure of less than one hour are not absolutely reliable. Lesser periods do not absolutely sterilize closely packed gloves. One hour is held to be safe for both loosely and tightly packed gloves. He, however, favors the method of placing the cotton glove inside the rubber one. W. C. DANFORTH.

A Study of Eclampsia Based on 250 Cases. R. MCPHERSON. *Bulletin of the New York Lying-in Hospital*, 1910, vol. vi, 123.

Two hundred and fifty cases were found in a series of 14,899 labors, being a proportion of about one case to every 60 labors (1.7 per cent).

The high percentage here noted may be ascribed to the fact that the hospital serves as a place of final resort for many cases occurring outside of its regular service. In comparison with these statistics, which are taken from the indoor department, a similar study of cases from the outdoor service in the hospital shows that eclampsia occurs but once in every 1,057 labors (0.9 per cent), that is to say, it was encountered forty-three times in 46,252 cases of labor. In the series herewith reported, eclampsia was noted in the antepartum cases 140 times, or 56 per cent; or in the postpartum cases 86 times, or 34.4 per cent, and in the intrapartum cases, 254 times, or 9.6 per cent. The youngest patient was fifteen and the oldest forty-eight years of age; the greatest number of cases occurred between the ages of twenty and twenty-five. The condition was almost twice as common in primaparæ as in multiparæ. There were seventy-seven maternal deaths (30.8 per cent), and 110 (44 per cent), of stillborn children. Among the maternal deaths 62.3 per cent occurred in the antepartum cases, 31.1 per cent in the intrapartum cases. Comparing these figures with those of the outdoor department, it is found that among the series of forty-three cases of eclampsia ten of the patients died, a mortality of only 23 per cent. The treatment was prophylactic and curative. In this series delivery was accomplished by manual dilatation and internal podalic version in eighty-nine cases, by forceps in forty-nine cases, by craniotomy in fourteen cases, by abdominal Cæsarean section in ten, and vaginal Cæsarean section in two cases. Labor was induced by means of bags seven times. The maternal mortality following version was 38.5 per cent, forceps delivery 20.5 per cent, induction of labor 28.5 per cent, and Cæsarean section 40 per cent. The fœtal mortality after version was 62.9 per cent, after forceps 44.4 per cent, after induction of labor 28.5 per cent, after abdominal Cæsarean section none. The writer calls attention to the fact that these high mortality figures are not entirely due to the eclampsia, but rather to the delay in sending the cases to the hospital. In a number of these cases scopalamin hydrobromate was used with very satisfactory results. Prompt emptying of the uterus and proper elimination constitutes the keynote of the treatment in this condition. C. G. GRULEE.

The Significance of Some Anærobes in Pathological Conditions Especially in Puerperal Diseases (Zur Bedeutung einiger Anæroben in der Pathologie, insbesondere bei puerperalen Erkrankungen). DR. HUGO SCHOTTMÜLLER. *Mitt a. d. Grenz. d. Med. u. Chir.*, bd. 21, h. 3.

The author first reviews the beginning recognition of the anærobes as the cause of disease, quoting Krönig, who discovered the anærobic streptococcus, and others.

The author first found this organism in 1896 in the cerebrospinal fluid of a meningitis following otitis media.

His observations of twenty-five cases in which the streptococcus putridus was found comprise otitis media, meningitis, cystopylelitis, pulmonary abscess, pulmonary gangrene, pleural empyema, endometritis putrida, salpingitis, parametritis, peritonitis, abscess of parametrium, sepsis with thrombosis.

In part of these cases the streptococcus putridus is taken to be a secondary cause of the conditions present, possibly the melting down of the tissues being due to it, as no remains of fibrin or elastic tissue were to be found in the exudates.

In the infections mixed with the streptococcus of erysipelas, streptococcus vaginalis, bacterium coli communis, pneumococcus, etc., the author thinks the streptococcus putridus plays the greater rôle as this organism alone is found to be possible of causing a

general infection. He shows its presence in 5 cases of endometritis, the organism being cultivated from the cervical discharge.

In two cases of peritonitis with thrombophlebitis the organism was found to have entered the peritoneal cavity by way of the Fallopian tubes.

In 4 cases of puerperal sepsis with thrombophlebitis the organism was taken to be the sole causative agent.

The study of a table of 1,000 cases of fœtal septic abortion shows that the streptococcus putridus was the causative factor in 25 per cent, being more frequent than the streptococcus of erysipelas, and even more frequent than the bacterium coli communis, which occurred in eight cases only.

In explanation of this the conclusions are that as the streptococcus putridus, as well as the bacterium coli communis are at times found in the vagina, and that nearly all of the cases were criminal abortions and the organisms were introduced into the uterus or through a cervical laceration.

It is desirable from a therapeutic standpoint to make an exact and complete diagnosis of the cause and extent of a puerperal infection. If a streptococcus putridus thrombophlebitis is present, ligation or extirpation of the veins is indicated (spermatic or even the iliac), this condition can be palpated.

Repeated chills always show that an inflammation of the veins is present.

In conclusion: 1. The streptococcus putridus is a specific cause of pathological conditions.

2. In putrid pus cases one must think of this organism, especially when streptococci are present in the pus.

3. When an ærobic culture in such cases fails one can with considerable certainty look upon the streptococcus putridus as the cause of it.

4. The fetor in bronchiectasis, pulmonary gangrene, cystitis, otitis media, and thrombophlebitis, is due to this organism.

5. The cause of putrid infection during the puerperium has been found.

6. By this knowledge diagnosis and therapy have been benefited.

The clinical course of three cases of septic abortion with infection from bacterium ærogenous capsulatus is given; only one of these cases died; this case had symptoms of cerebral apoplexy; the autopsy did not show the cause of death, but the bacteriological examination did clear it up.

Two cases of septic abortion with tetanus infection are reported in full, one of these lived after extirpation of the uterus, the other died in spasm.

Of special value in puerperal sepsis is the examination of the cervical discharge, not only for ærobes but also anærobes. In three months following the above report the author reports fourteen cases of puerperal infection with streptococcus putridus, with four deaths. In the same time 121 septic abortions with only one infection, with streptococcus erysipelatus.

HERBERT A. POTTS.

Statistical Report on 60,000 Labors. J. W. MARKOE. *Bulletin of the New York Lying-in Hospital*, 1910, vol. vi, 101.

Markoe reports a series of cases from the Lying-in Hospital during a period of about twenty years. They include not only actual cases of labor, but also abortions, ectopic gestations, and hydatidiform moles. Children born 80,878. Maternal mortality 0.94 per cent, accounted for by the fact that many cases are admitted in a very serious condition, and none are refused except in the presence of contagious disease. The majority of the deaths occurred in women who had been under treatment by outside physicians and midwives, but who were unable, for various reasons, to complete the delivery. One hundred and sixty-six cases of puerperal septicæmia, out of a total of 566 deaths. Eighty-five cases of eclampsia resulted fatally, the next most frequent cause. The percentage of twin births was 1.42 per cent, and the triplets, 0.25 per cent. Labor was induced in 256 cases, the most frequent indication being deformed pelves. Forceps were used in 4.46 per cent of all the cases. Version was done in 2.23 per cent. Placenta prævia occurred in 5.52 per cent. Cæsarean section was done 197 times or in 0.33 per cent of the cases. The maternal mortality among these patients was 6.45 per cent in the uncomplicated cases; among those with complications it was 32.88 per cent. Vaginal section was performed thirty times, with a maternal mortality of 13.33 per cent. There were 2,541 cases of abortion in the series, with a maternal mortality of 1.93 per cent. Forty-seven cases of ectopic gestation were treated with a mortality of 21.28 per cent; an immediate operation was done in twenty-six cases, with a mortality of 23.08 per cent, and a deferred operation in twenty-one, with a mortality of 19.05 per cent. C. G. GRULEE.

BOOK REVIEWS

SURGERY, ITS PRINCIPLES AND PRACTICE. Vol. IV. Edited by William Williams Keen, M. D., LL. D, and John Chalmers Da Costa, M. D. Philadelphia: W. B. Saunders Co.

After the manner of the preceding numbers, the fourth volume of this system is made up of a series of monographs of unusual merit, each apparently the result of special effort in the part of its author. Its seventeen chapters include, in addition to several minor chapters, the surgery of the abdomen, except such parts as were taken up in the third volume, and serve to form a very complete treatise. The illustrations are abundant, and of a high quality. The various chapters are well balanced, in logical sequence, and by authors whose standing in their various fields of work makes them authoritative

ATLAS ZUR MIKROSCOPISCHEN DIAGNOSTIK DER GYNAKOLOGIE. Nebst einer Anleitung und erläutendem Text von Priv. Doz. Dr. Rudolph Jolly, Oberartz der Königl. Universitäts-Frauenklinik zu Berlin. Berlin and Vienna: Urban and Schwarzenberg, 1910.

While there has been no lack of texts on gynecological diagnosis, either in the German or in our own English, up to this time a collection of plates illustrating the microscopic phase of this work has been a glaring defect in the literature on the subject. The atlas now brought out by Jolly makes good this defect in part and presents that part excellently, indeed. The volume, of eighty-five pages, comprises a series of fifty-two plates, with a short, concise, explanatory text opposite each, and in so far as it goes is probably not equaled by any production in English or German. The plates are very good examples of one- and two-color lithographic reproductions, and reveal an adequate understanding on the part of the artist of the subject matter studied. The work is incomplete, and in so far the title is misleading, in that the material studied is limited entirely to the vagina and uterus, there being nothing presented relative to the tube or ovary. It is evident, however, at the outset, that the author has endeavored to demonstrate only such conditions as may be microscopically diagnosticated from material secured *per vaginam* by scrapings or by excisions. In other words, the volume is confined to the diagnosis of the various pathological conditions presenting in the mucous membranes of the vagina and of the cervix and corpus uteri. The method of mounting the plates, however, while artistic and costly, makes a book rather uneven in dimensions and some of them, unfortunately, are somewhat overreduced, so that the more minute histology which the work is designed to set forth is not evident except to the trained pathologist. On the whole, it were perhaps better had the drawings occupied a greater portion of the page and hence allowed greater enlargement of detail. Such defects, apt enough to occur in a new work, may be readily overlooked in the general appreciation of the atlas as a whole.

The first two plates present these two membranes in their normal phase, next is taken up the various forms of endometritis, next erosion of the portio, next the changes normal in menstruation and pregnancy. Vesicular moles, chorio-epithelioma and the malignant changes characteristic of carcinoma and "adenoma malignum" are very well described.

Sections showing cervical polypi, condylomata, and two smears from vaginal and urethral discharges, complete the work. CAREY CULBERTSON.

A MANUAL OF MIDWIFERY. By Henry Jellett, B. A., M. D. Second edition. New York: Wm. Wood & Co., 1910.

It is a pleasure to welcome the second edition of Jellett's Manual in its new and improved form. The text has been carefully revised and evidently the search in the literature for new material that has been authoritatively established has been quite exhaustive. The reviewer regrets that one or two minor points have been overlooked apparently in this edition. For instance, the use of the binder for firm constriction of the breasts as a check to lactation either with or without such an application as belladonna, has been generally abandoned by teachers this side of the water as unnecessary, painful, useless, and otherwise objectionable, while on the contrary, no reference is made to Momburgs' constrictor in cases of post-partum hæmorrhage.

Of course the use of forceps with the patient in the lateral position looks queer to those of us who are accustomed to the dorsal decubitus, but this is a variation which is entirely a matter of technique and training. It may seem invidious to find fault where a book has been so competently worked out and so comprehensively digested, but it is not in the spirit of criticism so much as a means of taking a mental observation — a course which is particularly desirable in a book from across the water. The press work has been done in an exceptional manner and the book in every way reflects credit upon author and publisher. Too many of our textbooks at present are compiled by a writer chosen by the publishers, who control and revise the book, until the author loses his individuality in a mass of rampant commercialism, and in this respect the present work is a comfort to the soul. It is comprehensive but concise, and bears throughout the marks of individualism and authoritative authorship. CHARLES B. REED.

CANCER DU SEIN ET SON TRAITEMENT OPÉRATOIRE. By Dr. W. Sampson Handley, translated by Dr. Adrian Lippems. Brusse's: H. Lamertin; Paris: A. Malone.

This is an exhaustive work on the important and frequent condition, cancer of the breast. It is made doubly interesting by the competence of its author and the wealth of clinical and original pathological information which it contains. The author discusses his theory of lymphatic permeation, which theory, we believe, is surely not limited to cancers of the pectoral region. For the author, the embolic theory is insufficient. By the embolic theory we understand that particles of the primary cancer enter the blood stream and are conveyed by it to distal parts. At point of lodgment germination may occur and secondary cancer nodules develop. Embolism is an impartial process to which all organs are exposed. But the distribution of cancerous matastases is not at all impartial; some organs are frequently involved; others only exceptionally. Furthermore, cancerous particles invading the blood should pass through the lungs before gaining access to the general circulatory system. How explain by this theory the fact that in 175 cases of cancer of the breast, the lungs were involved but 7 times? The author is of the opinion that the dissemination of carcinomata takes place entirely through the lymphatic vessels and not through the blood-vessels. This propagation along the lymphatic vessels the author styles permeation.

The secondary cancers occurring in the course of cancer of the breast, the author divides into two classes; the external and the internal. The external include secondary nodules in the skin, subcutaneous tissue, aponeurosis, muscles, and bones. The internal secondary cancers include such as develop in the thoracic and abdominal cavities and in the central nervous system.

Hadley points out that degeneration and destruction of the cancer cells are not due to phagocytosis, because the lymphocytes do not make their appearance until degeneration has existed for some time. Neither is it due to the development in the fluids of the body of anti-cancerous properties, for at the edge of the growth or outside of the area of degeneration, the cells may exhibit a vigorous vitality, and in any case will be found spreading actively along the lymphatics. The real cause, Handley holds, is found in the fact that "the epithelial cell is an obligate parasite upon the connective tissue cell. Fibrosis of the primary growth is often interfered with by the onset of sepsis."

The author believes that the cancerous propagation or the permeation is accompanied by the associated destruction of the lymphatic system. This gives a satisfactory anatomical base to the œdema of the arm, so frequent in mammary cancer. He believes that accompanying the proliferative process there is also a reparative process. Clinically this reparative process may manifest itself by the disappearance of secondary foci. The organism of a cancerous individual is not an inert culture medium for the malignant epithelium On the contrary, it is a battlefield where a bitter fight is waged between the normal and the cancerous tissues The opposing forces may be nearly equally balanced, such as occurs in atrophic scirrhus cancer, owing to the almost limitless proliferative power of the cancer cells and to the defective defenses of the organism. Hence, in the majority of cases myriads of cancer cells are destroyed before the patient succumbs. Almost always the final victory rests with the cancer cells.

Dissemination is of two forms, parietal and visceral. Usually they occur together. Nevertheless, the division is a natural one and not a conception of the mind. Out of 470 autopsies held at the Middlesex Hospital, of patients dying of cancer of the breast, in 11 cases secondary nodules were present in the skeleton alone.

The author's theory of lymphatic permeation is illustrated profusely and convincingly.

The author's technique for removal of cancer of the breast is given at length and is well illustrated. In our opinion the book is most interesting and instructive reading for gynecologists and for surgeons. We recommend its perusal to all of our confrères.

AIMÉ PAUL HEINECK.

BOOKS RECEIVED

MANUAL OF OPERATIVE SURGERY. By Sir Frederick Treves. Vol. II, third edition. Philadelphia and New York: Lea & Febiger, 1910.

DIFFICULT LABOUR. By G. Ernest Herman. London and New York: Cassell and Company, 1910.

GENERAL SURGERY. Volume II, Practical Medicine Series. By John B. Murphy, M. D. Chicago: The Year Book Publishers, 1910.

HANDBOOK OF ELECTROTHERAPEUTICS. By William James Dugan, M. D. Philadelphia: F. A. Davis Company, 1910.

OPERATIVE SURGERY. By John J. McGrath, M. D. Third edition. Philadelphia: F. A. Davis Company, 1910.

DISEASES OF THE COLON. By P. Lockhart Mummery, F. R. C. S. (London). Bristol: John Wright & Sons, Ltd., 1910.

THE RAT AND ITS RELATION TO THE PUBLIC HEALTH. By various authors. Washington: Government Printing Office, 1910.

A SYSTEM OF SYPHILIS. Volume IV, Syphilis of the Nervous System. Edited by D'Arcy Power and J. Keogh Murphy. New York and London: Oxford University Press, 1910.

A SYSTEM OF OPERATIVE SURGERY. Volume IV. Edited by F. F. Burghard, M. S., F. R. C. S. New York and London: Oxford University Press, 1910.

MYOM BEI SCHWANGERSCHAFT GEBURT UND WOCHENBETT. By Prof. Dr. Landau. Berlin: Urban and Schwarzenberg, 1910.

Fig. 1—Appendiceal Intussusception. Specimen as removed
A—Opening into base of appendix. B—Inverted Cæcum invaginating appendix.

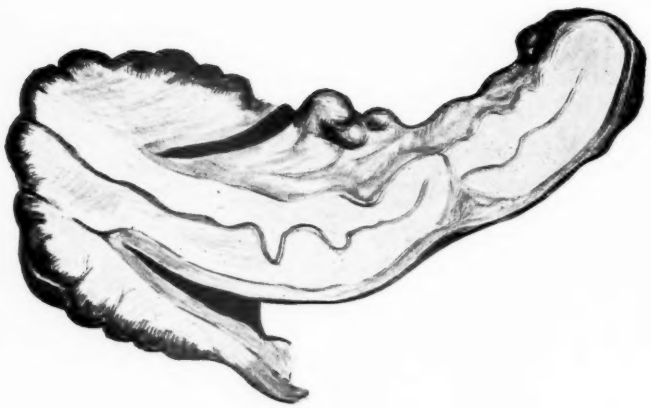

Fig. 2—Specimen bisected

W. T. Schwarz